The American Journal of Surgery

Editor: THURSTON SCOTT WELTON, M.D., F.A.C.S., NEW YORK

The American Journal of Surgery

CONTENTS OF NEW SERIES, VOLUME VI
ORIGINAL ARTICLES

Contents

VALUE OF OXYGEN TREATMENT AFTER THYROIDECTOMY*

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IN a previous paper on oxygen therapy we called attention to an hitherto unobserved phenomenon, a sharp, crisis-like drop in temperature which usually occurred following the administration of oxygen to patients whose temperature was elevated and who were cyanotic as the result of pulmonary edema, or bronchopneumonia. We also reviewed the literature on the physiological factors and the anatomical arrangement of the bronchi and alveoli which in these conditions are unfavorable for the complete oxygenation of hemoglobin. This drop in temperature, being an objective sign of the beneficial influence of properly administered oxygen in the appropriate case, has served to emphasize the harmful effect, as pointed out by Haldane, of allowing even a mild degree of anoxemia to persist. Furthermore, in cases of hyperthyroidism, anoxemia may develop easily and lead to more serious consequences because of the relatively increased consumption of oxygen. Asher and Duran caused hyperthyroidism in rats by the administration of thyroid extract and found an increased sensitiveness to oxygen deficiency. Similarly, Asher and Streuli found that rats whose thyroid gland had been removed did not show any of the phenomena of suffocation exhibited by normal animals in atmosphere deficient in oxygen.

Auer and Gates, and Leo Loeb, in their studies of the causes of pulmonary edema in rabbits following intratracheal administration of epinephrine, found that the edema could be prevented by any method which diminished the increased negative intrapulmonary pressure caused by the administration of the drug. Loeb emphasized that the more intense the inspiratory movements, the greater the tendency to withdrawal of fluid from the blood, a tendency which would be favored, as pointed out by Johnson, by overdistention of the pulmonary vessels from temporary incoordination of the volume output of the right and left ventricles (Welch).

Not enough attention has been paid to the theory of acute pulmonary edema advanced in 1878 by Welch, who was then working in Cohnheim's laboratory at Breslau. In 1904, Welch (in a personal communication to Meltzer) restated his theory of a mechanical explanation of acute pulmonary edema as follows: "A disproportion between the working power of the left ventricle and of the right ventricle of such character that, the resistance remaining the same, the left heart is unable to expel in a unit of time the same quantity of blood as the right heart."

Partial tracheal obstruction is occasionally noted following thyroidectomy,

usually as a result of excessive tracheal mucus, with or without laryngeal edema or spasm. Cardiac disturbances not infrequently follow thyroidectomy in cases of hyperthyroidism and whereas these disturbances are as a rule not apparently serious in themselves, they may be contributing factors to the production of pulmonary edema, particularly if there is interference to the free passage of air to such a degree as to prevent efficient aeration of the blood. The use of oxygen in such cases may, by decreasing the force of respiration and overcoming cyanosis, be a means of breaking a vicious circle at its most vulnerable point.

We have been particularly watchful of patients with hyperthyroidism both before and after operation in an effort to detect the slightest degree of cyanosis in order to institute early treatment in the oxygen chambers. We have also treated in the oxygen chamber patients with complications which if more extreme would have resulted in detectable cyanosis. In this group are included patients with pulmonary edema, early bronchopneumonia, and mechanical obstruction to the air passages by excessive mucus in the trachea, distortion of the trachea from pressure or vocal-cord paralysis. In many instances, cyanosis will not be apparent if the patient is lying quietly, but will become so on his sitting up in bed, with the attendant increase in oxygen consumption. Also the cyanosis may be intermittent; often it is present only during sleep, particularly in cases of disturbances of innervation of the vocal cords. In these cases the patient's conscious effort during waking hours will keep the larynx sufficiently open to prevent cyanosis, but anoxemia may develop during the relaxation of sleep. While the patient is awake he may be able to clear the trachea of mucus frequently enough to prevent much interference with respiration but while he is asleep it may accumulate sufficiently to cause considerable cyanosis, especially if at the same time there is a falling back of the tongue and lower jaw.

It has been our experience that patients with cyanosis or on the verge of cyanosis are much more comfortable following admission to the oxygen chamber. Undoubtedly in many cases analyses of blood gas would show slight oxygen desaturation in those patients who do not show clinical cyanosis. Besides the patient's increased comfort in the oxygen chamber there is often a characteristic crisis-like drop of from 2°F. to 6.5°F. in temperature in the first six to twelve hours. There is usually a drop in the respiration rate, and especially a diminution in the exertion of respiration with its attendant decrease in the intrapulmonary negative pressure, and therefore a lessened tendency to the development of pulmonary edema. The pulse also is usually slower.

The present study includes 91 cases of exophthalmic goiter, hyperfunctioning adenomatous goiter, adenomatous goiter without hyperthyroidism, and carcinoma of the thyroid, in which partial thyroidectomy had been performed and the patients, for various reasons, were sent to the oxygen chamber following operation. These cases represented a large proportion of the serious postoperative reactions from more than 5000 cases of goiter in which operation was performed during the period from January, 1926, when the oxygen chambers were first completed, to June, 1928. Almost all the patients with goiter who died during this time from any cause had been admitted to the oxygen chambers. Of these 59 had exophthalmic goiter, 27 hyperfunctioning adenomatous goiter, 4 adenomatous goiter without hyperthyroidism and 1 carcinoma of the thyroid gland. Of these patients 67 lived and 24 died. The oxygen concentration in the chamber varied in different cases. As a rule, oxygen was kept at a concentration of 50 to 60 per cent. If a patient's cyanosis persisted, higher concentrations were used, but this was rarely necessary, and probably concentrations of more than 60 per cent were not of any particular advantage to the patient. As the clinical condition

improved, the oxygen tension was gradually decreased to 30 per cent before the patient was removed from the chamber. Binger has shown that irritation of the lungs or other untoward effects are not produced by concentrations less than 70 per cent.

The most striking effect to be noted from the bedside charts of patients suffering from pulmonary edema, bronchopneumonia, slight cyanosis or elevation of temperature is the drop in temperature following admission to the oxygen chamber. Of the 91 cases there was a drop in temperature in the first twelve hours in the chamber in 75. The greatest drop in temperature in twelve hours was 6.5°, and the average drop was 2.1° during the first twelve hours. Of the patients who lived, the average drop was 2.4°, and of those who died, 1.5°. It is interesting to compare these figures with averages based on the pathological condition present. The most marked drop in temperature was either in cases of pulmonary edema or of bronchopneumonia; there were 47 of these and the average drop in twelve hours was 2.8°, as compared with 2.1° for the entire group. That this drop in temperature is not a chance or coincidental phenomenon is shown by the fact that in 37 of the 91 cases a drop of 3° or more occurred in the first twelve hours. Conversely, following the patient's removal from the chamber, there was often an immediate rise in temperature above the previous average level. This could be lowered again by readmission to the chamber. In 55 of the 67 patients who lived, there was such a rise within twelve hours of removal from the chamber; it did not, however, prove serious in any case in this series. The greatest rise was 4°, and the average of the 67 cases was 1.7°. In all cases there was on each succeeding day a gradual decrease so that after from two to four days the temperature was nearly or quite normal. Patients with labored respiration from frank pneumonia or obstruction of the upper respiratory tract from whatever cause were greatly relieved immediately by the oxygen treatment. In the latter group tracheotomy was frequently avoided; in the 23 cases in which obstruction was the important complication it was performed only four times. There were only 2 deaths in the 23 cases; in 2 frank bronchopneumonia was also present.

In 65 of the 91 cases definite cyanosis was present on the patient's admission to the chamber. The average drop in temperature was 2.6° in twelve hours. The degree of cyanosis was slight in most cases, especially in the more recent ones, as we have considered it the important indication for the use of oxygen, and have made an effort to institute treatment at its earliest manifestation. The cyanosis was controlled at once in all cases but in a few instances it reappeared even in concentrations of oxygen from 50 to 60 per cent as the pneumonia progressed in both lungs. In cases in which it was necessary to use progressively higher concentrations of oxygen to control the cyanosis and in which finally it was impossible to control it, all the patients died. At necropsy the pulmonary involvement was found to be far more extensive than is usually noted at necropsy. This fact, as emphasized by Robertson in his discussion of the necropsy reports, must not be misinterpreted to mean that the oxygen treatment aggravated the condition. The explanation lies in the fact that these patients were kept alive several days longer than they otherwise would have lived, and as the bronchopneumonia was of the progressive type sufficient time elapsed for this extensive involvement to develop.

In a few cases oxygen has been administered with the oxygen tent alone, but these cases have not been included in this series. We have used the tent only when the two chambers connected with our service were occupied. If patients are not restless, and do not need much nursing attention, the results of treatment in the tent may be perfectly satisfactory. Occasionally a patient who is treated with

difficulty in a tent will be easily cared for in the chamber. In such cases, of course, the advantages of the chamber over the

FIG. 1.

tent can be more clearly observed and the drop in temperature and pulse is much greater after admission to the chamber than had occurred after admission to the tent. The use of the tent necessitates more constant technical attention and more frequent analysis of the oxygen, but if it is properly managed and the patient is cooperative, the results may be satisfactory. Wilder has reported on a large series of cases following abdominal operation in which the oxygen tent has been used with very gratifying results.

A direct comparison of mortality rates in the treated and untreated groups has not appeared feasible, since the surgical mortality rate in exophthalmic goiter (Pemberton) has been less than 1 per cent

for several years. Various other factors influencing the mortality rate in previous years would also prevent a satisfactory

FIG. 2.

comparison. The beneficial effect, therefore, of oxygen therapy, so far as this study is concerned, must be determined by clinical judgment and observation rather than by statistical methods. We do not feel hesitancy, however, in stating that the mortality from goiter during the last two years was somewhat lower than it would have been without the use of oxygen.

CASE REPORTS

CASE I. A woman, aged thirty-three, had had a moderately severe exophthalmic goiter for four years. At the time of examination the basal metabolic rate was +34 per cent. Preoperative treatment with compound solution of iodine was carried out over a period of twelve days, after which partial thyroidectomy was

performed. On the second day, the temperature had risen to 104.8°F.; the patient was quite ill, very uncomfortable, and slightly cyanotic. A few râles were heard at the left base of the chest, but evidence of consolidation was not present. The patient was admitted to the oxygen chamber. The cyanosis disappeared immediately and she was more comfortable. There was the usual drop in temperature and pulse, the temperature falling 3° in twenty-four hours, and reaching 100°F. after three days in the chamber. After removal from the oxygen chamber, there was the usual slight rise in temperature (Fig. 1), but serious reaction did not occur. This patient was considered much improved by oxygen treatment.

CASE II. A woman, aged twenty-one, with a severe exophthalmic goiter of six month's duration and a basal metabolic rate of +59 per cent was treated with iodine prior to operation. During this time epidemic parotitis developed from which recovery was uneventful, although there was a severe reaction. After several days of normal temperature, partial thyroidectomy was performed. The day after operation the temperature was 104°F. When the patient was at rest, there was slight cyanosis, but this was much more marked after she moved about in bed. She was admitted to the oxygen chamber, where she was much more comfortable, but there was considerable rise in temperature daily (Fig. 2), and the reaction seemed to be of the infectious type. On the fourth day there were frank signs of pneumonia over the lower left lobe.

CASE III. A woman, aged sixty-seven, had had exophthalmic goiter for two months, and a basal metabolic rate of +72 per cent. Because of the intoxication, she was kept under treatment with iodine for three weeks, after which partial thyroidectomy was performed. On the second day, the temperature rose to 103°F., and the pulse to 200. The auricles were fibrillating. Râles were heard at the right base, but consolidation was not evident. There was slight cyanosis. After admission to the oxygen chamber the patient was more comfortable, the pulse fell, cyanosis disappeared, and the temperature dropped 4° in twelve hours. During the first few days the sputum was blood-streaked but frank consolidation was not discovered. The course is shown in Figure 3.

CASE IV. A girl, aged twenty, had suffered from an extremely severe exophthalmic goiter for more than three years. She was admitted
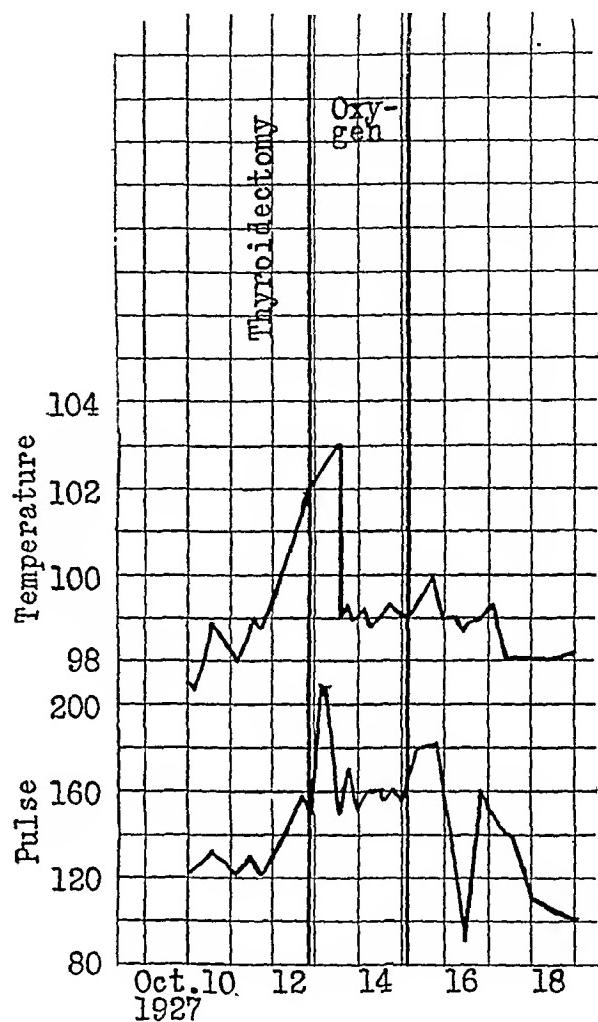
FIG. 3.

during the stage of a gastrointestinal crisis, at which time she was so weak that she could not sit up in bed. After prolonged medical treatment with iodine, partial thyroidectomy was performed. There was a severe hyperthyroid reaction with a sharp rise in pulse and temperature, and slight cyanosis of the fingernails. She was admitted to the oxygen chamber the day of operation. The usual drop in pulse and temperature occurred, but on the second day the temperature rose to 102°F., and there was distinct evidence of pneumonia in the left lower lobe. After a rather severe reaction, the temperature became normal on the ninth day, after which convalescence was uneventful. In this case, the patient was in an extremely poor condition due to long-continued severe

exophthalmic goiter. It is doubtful if she could have withstood the pneumonia without the benefit of oxygen.

SUMMARY

Oxygen was administered to patients having severe reactions after thyroidectomy, especially those with cyanosis resulting from pulmonary edema, bronchopneumonia, and laryngeal or tracheal obstruction. The patients showed, as a rule, marked subjective improvement. Usually the fever subsided rapidly. Pulse and respiration rates were lowered. Dyspnea was partially or completely relieved. It is probable that the development of pneumonia was prevented in many instances. The observations suggest that not infrequently death may be prevented by efficient oxygen treatment in suitable cases.

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THE USE OF IODINE IN HYPERTHYROIDISM*

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I N the light of our present knowledge, of the use of iodine in hyperthyroidism, it seems to me that the following twelve questions offer material for discussion:

1. Is iodine *always* of value in exophthalmic goiter; that is, do certain patients with this disease fail to respond to iodine therapy?

2. Do all patients with hyperthyroidism improve with iodine? What effect has iodine in cases of toxic adenoma?

3. Does iodine initiate hyperthyroidism in non-toxic adenoma?

4. May iodine hyperthyroidism develop in any adenomatous goiter? Is the dosage of iodine or the time element important?

5. Is the amount of iodine used in the preoperative treatment of exophthalmic goiter an important factor?

6. When iodine is given during the preoperative preparation of patients with exophthalmic goiter what is the most favorable time for operation?

7. How may iodine be best administered during and following operation?

8. Does the use of iodine eliminate the necessity for ligation or stage operations in exophthalmic goiter?

9. What effects follow the prolonged use of iodine in hyperthyroidism?

·10. Does the pathological picture of exophthalmic goiter ever show a state of complete reversion from hyperplasia to colloid following the use of iodine?

11. How long should iodine be continued postoperatively? Will prolonged use be beneficial or harmful?

12. What part does iodine play in hyperthyroidism on recurrence of symptoms?

I am presenting the problems briefly and trust that this will induce discussion which will emphasize certain factors that may be of extreme importance to those interested in the study of thyroid diseases.

As regards the value of iodine in exophthalmic goiter, it has been my experience that it has always proved effective in the primary treatment of this disease. There has been considerable discussion on this point, some physicians reporting that certain patients failed to respond to treatment. Although my experience has been limited to approximately 300 cases, there has been an almost immediate and remarkable response in every instance. In fact, so certain is improvement to occur that if the diagnosis is correct one can safely predict to the patient the progress of his condition. A patient may be brought in on a stretcher who has been bedridden for a month or longer while undergoing treatment for a supposedly bad heart. Is there any greater satisfaction than to be able to inform him that within a few days he will again be walking and on the way to recovery? I cannot help feeling that when iodine has not proved beneficial there has been an error in diagnosis, or in its use.

Do all patients with hyperthyroidism improve with iodine? My observation has been that they do not. This question again brings up the problem of classification, and the discussions which this subject called forth at the 1927 meeting of the American Association for the Study of Goiter will explain the futility of any attempt to renew it. I was surprised, recently, to read a report[1] from workers at the University of Michigan to the effect that iodine is satisfactory in the preoperative treatment

[1] YOUMANS, J. B. and KAMPMEIER, R. H. Effect of iodine in toxic adenoma. *Arch. Int. Med.*, 41:66, 1928.

of almost every case of toxic adenoma. Certainly this has not been my experience. In fact, my records will show cases in which not only the basal metabolic rate has increased, but the symptoms of hyperthyroidism have become intensified through the use of iodine in toxic adenoma. In occasional instances some improvement has been apparent although the influence of rest and symptomatic treatment may have been a factor. Never in my experience has the brilliant response to iodine been apparent as has been observed in exophthalmic goiter. Naturally, when exophthalmic goiter is associated with adenomatous goiter, as is true in about 1 in 4 cases, toxic symptoms rapidly subside with iodine.

As regards iodine hyperthyroidism I can only reaffirm my view that hyperthyroidism may be initiated in previously non-toxic adenomatous goiter by the indiscriminate use of iodine. I have attempted to show that this condition is a distinct clinical entity and should not be confused with either exophthalmic goiter or toxic adenoma. The great amount of evidence that has accumulated in this country as well as abroad argues against the idea that this condition is one of theoretical rather than practical consideration. Numerous workers in this country have called attention to the increased incidence of this condition, and last year at the international goiter convention in Switzerland special attention was given the subject. Several hundred cases of iodine hyperthyroidism have now been reported in the literature, including 3 fatal cases which I have observed. This problem is one which impresses not only the laity but the profession as well with the fact that iodine is a drug and not a food, that it should not be used indiscriminately even in children, and, except in pregnancy or in preparation for thyroidectomy, it should not be used either in large amounts or for long periods of time by persons having adenomatous goiters.

It is true that certain persons having adenomatous goiter appear to have a definite resistance to the deleterious effects of iodine. Experiments have been made to prove that hyperthyroidism cannot be produced by iodine in adenomatous goiter. Certain persons will tolerate iodine apparently indefinitely with no harmful effect; in other cases that I have observed, even in children, Lugol's solution or patent medicines containing iodine have initiated toxic symptoms in less than two months. Small amounts of iodine may be tolerated for a considerable period of time in others, until a sudden accumulative effect seems to occur.

In 1922 Plummer made certain the wonderful results to be obtained with the use of iodine in conjunction with surgery in the treatment of exophthamlic goiter. At that time, I believe, the point was made that equally good results could be obtained with small as well as large doses of iodine. An early experience led me to believe that more immediate and marked improvement occurred with larger than with smaller amounts of iodine. Consequently the average dose given our patients has been 60 drops a day for a week. On the day of operation and on the day following this amount is at least doubled. Not only has the response to treatment seemed to be more speedy, but the degree of postoperative reaction has appeared to be considerably lessened. Likewise in the majority of cases the most favorable time for operation has seemed to be during the second week of preparation rather than later. However I realize that there is considerable room for discussion and I shall be interested to hear the views of others on this point. Naturally, patients who have been bedridden for some time, those who are extremely emaciated, or those in whom cardiac decompensation has occurred, may require a longer period of preparation.

In spite of the marked benefit from the use of iodine, certain patients with exophthalmic goiter continued to show a considerable degree of reaction following primary hyperthyroidism. Although no

fatal consequences resulted from this condition, the symptoms were often sufficient to cause considerable apprehension. Still, I always felt that if sufficient iodine could be retained the situation could be controlled. The most annoying factor was the repeated emesis and the occasional distressing tracheitis. Both of these conditions have been overcome by a method which I have been using during the past year and which I feel will be of general interest. In my experience no single factor with the exception of iodine itself has proved of such valuable aid in the treatment of this condition.

The plan which we have evolved is to introduce a duodenal tube on the evening preceding operation. This is done in all of the most toxic cases or those in which trouble is anticipated. This procedure permits the constant introduction of large amounts of fluid, iodine, and nourishment, not only during the morning of operation and the night preceding, but also during the period the patient is on the operating table, and the first afternoon which formerly was likely to be stormy. During the operation when the metabolic rate might be expected to be highest and the tendency to hyperthyroidism greatest, the patient is constantly receiving glucose, orange juice, and iodine or any other desired liquid. Under the influence of morphine and scopolamine the patient may quietly enjoy his breakfast the same as the other patients but without the trouble of swallowing. Moreover, the method is so simple as scarcely to require the services of a nurse, since the suspended container may be filled at the start with sufficient fluid to last during the operation. It has been our experience that even in the most toxic cases, following primary thyroidectomy, these patients experience little or no reaction after returning to their rooms. The temperature may rise to 101° F. and the pulse rate to 120, but seldom higher. Postoperative emesis and tracheitis are virtually eliminated. This method is also ideal in the treatment of cases with gastrointestinal crisis.

At this point I wish to reiterate the well-known and yet not generally understood fact that the prolonged use of iodine in exophthalmic goiter will lead to serious consequences. Among the several cases of this kind recently observed was one in which following a period of marked improvement, there developed cardiac decompensation and auricular fibrillation, another in which after a year's treatment the systolic blood pressure had increased to 268, and another in which hemiplegia had occurred. We should make it one of our duties to educate the profession and laity as well to the dangers of the prolonged use of iodine. While it may not be the responsible factor, still the disease progresses just as if no iodine had been used.

During the past year a valuable observation has been made, that those patients who appear to have developed a tolerance for iodine may again be restored to fair condition for operation by having the dosage of iodine greatly increased.

In a previous study of the pathological picture the fact was noted that iodine causes a reversion of hyperplasia to colloid, but that the change is never complete even after the prolonged use of iodine.

Since 1924 only one ligation operation has been performed at our clinic and in this instance no benefit was derived from it, nor was it expected, since the operation was done to determine the patient's ability to withstand thyroidectomy. Although it may seem a radical procedure, I believe that primary thyroidectomy may be safely performed in every case, provided there has been a proper period of preparation, the facilities are adequate, and the suggestions which I have just enumerated are carried out. It is true that we have lost patients under this plan, but I cannot attribute death to hyperthyroidism.

The time element in postoperative treatment with iodine is an involved question. In general the time is determined by the

condition of the patient at the time of operation, the amount of gland preserved, and the rapidity of recovery. The environment to which the patient returns is also a factor. If the metabolic rate has returned to normal within a month after operation, and the patient is gaining satisfactorily I see no reason for continuing the use of iodine. If only a small portion of the gland has been preserved (and no more should be saved than is absolutely necessary) I believe that long continued use of iodine may lead to the development of hypothyroidism, as has been suggested in the literature.

Although in my experience patients with primary hyperthyroidism are only temporarily benefited by the use of iodine, I feel that recurrence of hyperthyroidism following operation has been definitely and permanently prevented. Furthermore, the use of iodine over a few months' time does not seem to lead to serious consequences, although I believe prolonged use will. However, in most cases no benefit is derived and there should be a second operation.

I have briefly presented these points in the hope that they will stimulate discussion which will be helpful to all who are interested in further progress in the treatment of hyperthyroidism.[1]

[1] JACKSON, A. S. Goiter and Other Diseases of the Thyroid Gland. N. Y., Paul B. Hoeber, Inc., 1926.

BORDERLINE HYPERTHYROIDISM*

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IT is now quite generally accepted that if hyperthyroidism is present, the basal metabolic rate is elevated above normal, and, conversely, that if the basal metabolic rate is normal, no thyroidism exists. This statement is a good general rule, and we believe that the physician who sees but an occasional case of thyroid disease in his practice, and follows this rule, will make very few errors. In a clinic where large numbers of patients with real and suspected thyroid disease are examined, however, there are found a small group who are, apparently, exceptions to this finding. The diagnosis of this group of borderline cases of thyroid disease is always an interesting problem and frequently a matter of difficulty and uncertainty.

Clinically, cases of borderline hyperthyroidism fall into three groups: In one, the history and physical examination are entirely consistent with hyperthyroidism, yet the basal metabolic rate is normal or subnormal; in the second, neither the history nor the physical examination is typical of hyperthyroidism, yet the basal metabolic rate is elevated; the third consists of a group of neurocirculatory asthenic patients in whom the history and physical findings are both atypical; these can be properly interpreted only after learning the true basal metabolic rate and after repeated clinical examinations.

Since Lugol's solution has been widely adopted for the treatment of hyperthyroidism, many of the usual clinical aspects of the disease have been altered materially.

Today one rarely examines a patient with any kind of a goiter who is not taking or has not been given, iodine. One result of this therapy is that an occasional patient with true exophthalmic goiter will come to the clinic for the first examination in the progress of an iodine remission. Furthermore, spontaneous remissions may occur in the course of the disease. If the patient has had the disease a long time, the history will disclose a typical onset with the usual increased appetite, loss of weight, nervousness, rapid heart, and other characteristic subjective symptoms. The examination may show the residual effects of the thyroidism, such as pigmentation of the skin, exophthalmos, edema of the eyelids, irregular heart, a firm involuted thyroid gland, and possibly emaciation. The basal metabolic rate in such a patient, due to the iodine or to the spontaneous remission, may be either low or within normal limits.

In our opinion, such a patient still has exophthalmic goiter and should have a subtotal thyroidectomy. When we first encountered this type of case, early in our experience with thyroid disease, we frequently refused operation. It was then our firm belief that hyperthyroidism did not exist in the absence of an elevated basal metabolic rate. By that, we meant a rate well above the *average* normal range between +10 or −10. The fact was persistently impressed upon us, however, that these people who had the usual symptoms and signs of exophthalmic goiter were sick and incapacitated even though their basal metabolic rate was normal. Operation was, therefore, undertaken in certain cases and very marked improvement followed.

Check-up metabolism tests after the thyroidectomy often showed the basal metabolic rate to be definitely below the average normal level; yet the patients were clinically well. In a recent study of the end results in 100 cases of exophthalmic

* From the Lahey Clinic, Boston. Read before the American Association for the Study of Goiter, Denver, June 18–20, 1928.

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goiter followed for a year or more after operation, it was found that the basal metabolic rate was −10 or below in 19 cases. Only 6 of these patients, however, had any clinical evidence of myxedema.

It is our belief that there are many people who are perfectly well whose basal metabolic rate is commonly below −10 after thyroidectomy. Some observers believe that in these patients the basal metabolic rate in health is low and that a rate of +13 in such a case is equivalent to a marked elevation of metabolism in a patient whose rate is usually ±0. This is similar to Dr. E. P. Joslin's statement that a temperature of 99.2°F. in a severe diabetic is equivalent to a high fever in a healthy person.

In spite of the foregoing, however, it should be emphasized that great care should be exercised in the diagnosis of exophthalmic goiter in patients who have a normal basal metabolic rate. The presence of a soft colloid enlargement of the thyroid in a nervous, excitable, adolescent girl must not be hastily considered evidence of exophthalmic goiter. Repeated examination and tests are necessary in each case and great emphasis must be placed on the presence of the secondary symptoms of hyperthyroidism. Without positive evidence, it is better to withhold operation in these borderline cases. It is, furthermore, our experience that operation in such a case must not be lightly undertaken simply because the basal metabolic rate is normal. Serious postoperative reactions may occur in these cases and the operation must, in certain instances, be done in multiple stages. Each patient must be most carefully prepared for operation in spite of the low metabolism. Moreover, when operating upon this group of patients, it is desirable to leave a larger remnant of each lobe than is customary with the more toxic patients. Failure to do this may result in the occurrence of myxedema after operation.

If the patient who comes for examination during an iodine remission of the disease has had exophthalmic goiter for but a short time, the true diagnosis may be impossible at the first visit. In these cases nothing can replace, in importance, a carefully taken history with particular emphasis on onset, weight changes, appetite, menstrual history, muscle weakness and heart rate. The examination may disclose little positive evidence of hyperthyroidism other than a thyroid gland which is firm in consistency and slightly enlarged. Iodine treatment often causes the exophthalmos and stare to disappear, the tremor to vanish and the heart rate to return to normal. Furthermore, in these cases, the basal metabolic rate is often within normal limits or but slightly elevated. In certain patients in this group we may suspect hyperthyroidism in a remission, but, lacking sufficient positive evidence for the diagnosis, it is our custom to send them home for a period of six weeks of normal activity without medication of any kind. At the end of this interval they return for further examination and for further metabolism studies. If the metabolism is still normal and the symptoms are improved after this interval, we believe we must classify them as patients with no thyroid disease and refuse operation. If, however, they return after this interval with an exaggeration of their previous symptoms and an elevated metabolism, operation is advised.

The second group of patients whom we may term border-line is that group in which the symptoms and signs of the disease are decidedly atypical, yet on repeated examination the basal metabolic rate is elevated. The leading symptom in this group of patients varies greatly. "Nervousness" is perhaps the most frequently encountered, but loss of weight, trembling of the extremities, or palpitation not infrequently bring the patient for medical advice. Frequently basal metabolism tests are done on patients as part of a complete physical examination. Occasionally these tests are found to be high. It is then necessary to determine the significance of the high basal metabolic rate.

It is hardly necessary to stress at this time the importance of a most careful control of the actual technique of the test. We not infrequently examine patients whose metabolism is reported as very high, but whose true basal metabolic rate, after well-controlled or repeated tests, is found to be within normal limits. Certainly in every questionable case the test must be repeatedly taken and carefully checked before it is accepted.

It is, of course, well recognized that the basal metabolic rate is frequently elevated in lymphatic leucemia, polycythemia and pernicious anemia. In any unusual case presenting a high rate, the possible presence of one of these blood diseases may be settled at once by appropriate blood studies. We have noted certain patients with marked chronic nephritis and hypertension who constantly showed a basal rate of +40 or more. These cases are very difficult diagnostic problems and may easily be operated upon with the mistaken diagnosis of hyperthyroidism. It has been our experience that subtotal thyroidectomy fails completely to benefit the symptoms due to hypertension in these cases and that the basal metabolism persists at the same level after thyroidectomy. We have studied one such patient with hypertension who had a basal rate of +40 which varied very little with rest in bed and iodine. Subtotal thyroidectomy produced no change in either her symptoms or her basal metabolic rate. A year after operation she died of congestive heart failure and at autopsy showed no other cause for her difficulties than arteriosclerosis and chronic nephritis.

The correct diagnosis of many of these cases will finally depend on a most careful consideration of the history of the illness and a special search for any secondary symptoms of hyperthyroidism. We may consider exophthalmos, tachycardia, tremor, goiter, and an elevated metabolism as primary and typical evidence of hyperthyroidism. These findings are practically pathognomonic of exophthalmic goiter. In all exophthalmic goiter patients, however, careful questioning and examination disclose numerous other symptoms arising as a result of and in addition to these primary findings which we consider of secondary importance in determining the diagnosis. No one of these secondary symptoms is pathognomonic of exophthalmic goiter; but the presence of several of these symptoms and signs in a patient is frequently of definite diagnostic value. In all borderline cases, therefore, where the primary evidence of hyperthyroidism is absent, the secondary symptoms of hyperthyroidism become of great diagnostic importance.

Unaccountable variations of marked degree in the patient's weight in the absence of any other cause are very suggestive of hyperthyroidism. It has been our experience that a patient losing 20 or more pounds in spite of an exceptionally good appetite usually has either diabetes or hyperthyroidism. The fact that a trace of sugar is present in such a patient's urine does not settle the diagnosis, since it is very common to find a trace of sugar in the urine in hyperthyroidism. A fasting blood sugar and careful basal metabolic studies must be done to establish the correct diagnosis.

A sensation of increased body warmth is a valuable secondary sign in hyperthyroidism. Accompanying this are increased sweating and vasomotor instability, especially shown in the skin of the chest and neck. A diminution in the menstrual flow is commonly noted after the onset of hyperthyroidism. Complete amenorrhea may occur. Such changes in the menstrual flow become of distinct diagnostic importance in the patient suspected of having hyperthyroidism when considered with other findings. Attacks of diarrhea with or without vomiting, in the absence of any other cause, suggest a milder degree of the increased intestinal activity seen in the acute crises of hyperthyroidism.

Of less diagnostic value are the subjective nervous symptoms of the disease.

These are of importance only as the history notes their occurrence definitely with the onset of the present trouble. Thus it becomes significant if a person previously quiet and mentally composed develops marked emotional instability, passing from laughter to tears without adequate cause. Marked irritability and inability to put up with the trivial annoyances of life when developing in a patient previously amiable are suggestive of the presence of thyroidism.

Possibly the most important of these secondary evidences of hyperthyroidism is the evidence of muscle weakness. It is generally known that marked muscle weakness accompanies severe hyperthyroidism, but the diagnostic importance of this finding in the borderline cases is often overlooked. In many instances the history is specific on this point and states that the patient noted a marked loss of muscle power in legs or arms and that the knees became weak and often "gave away."

More often, however, the evidence of muscle weakness can only be obtained by some direct test of muscle strength. For this purpose we have found the quadriceps test devised by Dr. F. H. Lahey of distinct value. The patient while seated well forward on a chair raises one leg to a horizontal position with the knee extended. A marked strain is exerted upon the quadriceps extensor tendon and considerable muscular effort is required to sustain this position. The length of time that a normal person can maintain this position varies from forty seconds to two minutes or more. It is extremely rare to find a patient with any degree of thyroidism who can hold this position for more than thirty seconds. Occasional cases of undoubted hyperthyroidism may have no marked muscle weakness. A low quadriceps test, however, is valuable evidence of hyperthyroidism in the presence of other suggestive findings.

The diagnosis of the borderline hyperthyroidism patient who lacks the primary or usual evidences of the disease, but shows a high basal metabolic rate, will be dependent very largely on the history and secondary evidences of hyperthyroidism.

The differential diagnosis of neurocirculatory asthenia from early or borderline hyperthyroidism is in many instances dependent on long experience and observation. There is, furthermore, no patient for whom a thyroidectomy will do as little good or more harm than the neurocirculatory asthenic. One must, therefore, be constantly alert that he does not overthrow the already poorly balanced nervous system of this type of patient by an unnecessary thyroid operation.

Many of the symptoms of hyperthyroidism are commonly present in the neurasthenic and on this account must not receive undue emphasis in diagnosing the borderline case. Thus tremor, nervousness, palpitation, and rapid heart are leading symptoms consistent with either diagnosis. The mental outlook of the two diseases is vastly different. The neurasthenic is pessimistic and fearful of the future. The hyperthyroid patient is optimistic of her ability and hopeful of the future. The neurasthenic feels that she cannot do her daily work, but does it. The hyperthyroid patient feels sure she can perform most tasks, but after trial, fails.

Alteration in the menstrual function is rarely present in the neurocirculatory asthenic patient. Diminution or cessation of the menses is common in the toxic goiter case. The neurasthenic is plump and healthy in appearance, but says she can scarcely eat a thing. The toxic goiter patient usually has an excellent or excessive appetite, but nevertheless is thin or is losing weight.

The presence of a goiter is, in this type of patient, of course, most suggestive of hyperthyroidism. It does not by any means, however, confirm that diagnosis. We have repeatedly seen a moderate thyroid enlargement accompanied by symptoms of neurocirculatory asthenia

which were so confusing that they could only be interpreted properly when the basal metabolic rate had been found to be normal.

The basal metabolic rate is undoubtedly the only measure at present which will permit us to detect many of these cases of neurocirculatory asthenia. In any suspicious case the rate must be taken several days in succession before it becomes certain that the true rate has been obtained. It is our belief that in certain cases a rate a few points above the average figure may be just as normal for an individual as a rate a few points below the average normal figure. In the last analysis, the diagnosis in certain very doubtful cases will rest largely on the observer's impression of the patient and his experience with similar cases. When the diagnosis is as doubtful as this, it is usually the part of wisdom and good judgment to postpone the decision for or against operation until the time when more positive evidence of hyperthyroidism is present.

Exophthalmic goiter patients who have had a thyroidectomy occasionally return for examination because they fear their disease is again becoming active. This group of patients not infrequently presents unusual features that are worthy of note.

There are many of these patients who are chiefly troubled with worries rather than symptoms. They are fearful that the disease may be returning, although they have had no change in their health. Others of this group have slight pains in their neck or are attacked by "nervous spells" at frequent intervals which they believe point to a return of the goiter. Rarely one encounters a patient who is obviously a severe neurasthenic and who reports a group of symptoms which reveal imaginary trouble in all parts of the body, but in no way point to any thyroid disorder. Such a case can generally be readily established as a neurasthenic and one may wonder if hyperthyroidism had been present before the thyroidectomy. Certainly an occasional visitor of this type will do much to deter the surgeon from early operation in borderline cases of hyperthyroidism.

There are, of course, certain patients who have very definite hyperthyroidism at varying periods of time after subtotal thyroidectomy. Some of this group are frankly toxic and the diagnosis is obvious, while others are so mildly toxic that many are borderline cases and require careful diagnostic study.

Some time ago, Dr. F. H. Lahey and the writer[1] called attention to the fact that hyperthyroidism present after thyroidectomy for exophthalmic goiter might be a true recurrence of the disease, but that in the majority of cases it was simply a persistence of the disease. The only difference between persistent and recurrent postoperative hyperthyroidism is in the time of their onset.

Persistent postoperative hyperthyroidism results from the surgeon's failure to remove enough hyperplastic thyroid tissue. Failure to remove sufficient tissue in any given case is most frequently due to the inexperience of the operator, to unusual technical difficulties in the operation from hemorrhage, or intense intoxication, or to improper judgment as to the degree of secretory activity inherent in the thyroid tissue left in the neck.

Since the last two possibilities are in a large measure unavoidable and occasional cases of persistent hyperthyroidism may occur, it has long been our custom to insist on repeated metabolism tests and clinical examinations of all toxic goiter patients after operation. We expect to find no clinical evidence of hyperthyroidism and a normal basal metabolic rate at the first examination three months after operation. If the basal metabolic rate is high at this time and there is still evidence of hyperthyroidism, we give the patient Lugol's solution m.x daily and ask her to return for another examination in six weeks instead of waiting the usual

[1] Lahey, F. H., and Clute, H. M. Persistent and recurrent hyperthyroidism. *Ann. Surg.*, 83: 199, 1926.

three months for the next test. If the test is high and there is still evidence of persisting hyperthyroidism at this time, further removal of thyroid tissue is urged.

The apparent absence of large remnants of thyroid tissue in such a case should not delay the advice for further operation. True persisting hyperthyroidism is caused by the overactivity of the thyroid remnants, whether they are large or small, and is cured by their removal. We have rarely, if ever, failed to find large thyroid remnants of hyperplastic tissue in any case of persistent hyperthyroidism that we have submitted to a second operation.

Occasional cases have been seen in which the patient's symptoms of persistent hyperthyroidism were completely relieved by the regular administration of Lugol's solution, but this group is quite small. These cases have shown neither high basal metabolic rates nor large thyroid remnants.

True recurrence of hyperthyroidism after a prolonged period of normal health may occur, but it is certainly unusual. Here again it is important to recognize the fundamental fact that the hyperthyroidism is due to an excess of hyperfunctioning thyroid tissue, and that it can be cured only by the removal of a large part of that tissue. Lugol's solution in these cases, as in any other case of primary hyperthyroidism, should be used only as a means of preparing the patient for operation, and should not be expected to produce a permanent cure unaided by surgery.

It is our belief that in either persistent or recurrent hyperthyroidism, further removal of thyroid tissue must usually be undertaken. The earlier this decision can be reached in any case, the better. We would much prefer to have a patient in need of daily thyroid medication than to have her constantly under the drive of a hyperfunctioning thyroid gland.

THE IODINE QUESTION IN ANIMAL EXPERIMENTS*

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THE subject I have taken the liberty of choosing is the question of iodine in experiments upon animals. But it is necessary that I first make some general remarks. Nowadays it is impossible to approach the subject of goiter from any point without it becoming a whole book. We stand on the threshold of a new orientation in the question of goiter that can never be overlooked. This new orientation extends over all the details of the teaching of the diseases of the thyroid gland.

It seems to me worth noticing that this new orientation consists, not in the giving of our present knowledge, but in the recognition of a connection which we have not known until now. In this way we have won a new basis for the diagnosis, prognosis and treatment of the diseases of the thyroid gland.

The International Conference in Berne in August, 1927, was very interesting and important. I confidently hope that the American Congress in Denver will become the starting point of a new teaching on the diseases of the thyroid gland. For we must agree upon some cardinal points.

When I say, "This man has a goiter," the trouble starts with the word goiter. I say no more than if I said, for example, "This man limps." But that is a very modest diagnosis. Why does the man limp? Has he coxitis? Has he a badly healed fracture? Ischias? Perhaps a wooden leg? To this question, "Why," the physician must give the answer, when even the children in the street can make the diagnosis "the man limps."

Why has this man a tumor on his neck, which tumor belongs to the thyroid gland? That is the first question.

We may find that the man has car-cinoma of the thyroid gland, sarcoma, dermoid, echinococcus, inflammation of the gland. All that does not belong to the problem of the thyroid gland. But if we find a diffused symmetrical swelling of the whole gland without any of the above mentioned diseases then it is an alteration of the gland which is characteristic of it as an endocrine organ. This alteration therefore, must have a connection with the function of the organ. That is the first step in the new teaching about the diseases of the thyroid gland.

The diffused alterations of the whole organ, and only this we shall call for the present by the name goiter, are the expressions of functional disturbance of the organ.

The second step must make the decision whether these functional changes are primary or secondary disturbances of the normal functions of the gland. To this thought we must give a short consideration.

There is an endemic, an epidemic, a sporadic goiter. The endemic and epidemic goiter have a decided histological character. The sporadic goiter can show different histological structures, but also those of the endemic and epidemic goiter.

It may be that in all these cases a certain malignancy is working in the gland and leads to the same injury. If that is so the goiter would be a primary disease of the thyroid gland and a certain histological picture belongs to this disease. But here an important factor comes into consideration. It is possible in experiments on animals to produce these histological changes which are characteristic of spontaneous goiter. From that we can see that these changes can be possible under different conditions. So they are not a

primary specific disease of the gland but much more the expression of a changed function through the influence of different causes.

Therefore the second diagnosis is: The functional diseases of the thyroid gland have a conditional nature, or in other words, the goiter is a symptom. As for the question of etiology, this diagnosis is the end of the dispute about uniform etiology. Different causes can be effective at the same time. So these causes can make the histological changes an expression of the same functional change. The dispute about the water theory, the iodine theory, the dirt theory, the infection theory and all the other theories loses its monopoly.

Not one alone, but everyone is right in some respects, because completely different conditions can lead to the same functional changes.

It is easy to understand what a great change this comprehension makes in the diagnosis, prognosis, indication and in the kind of treatment.

The solution of all these problems lay in the utilization of experiments on animals.

If I now come to the real subject of my address, I must point out how *little* the experiments on animals have been made use of in solving the questions.

Hurtle went along this road but he left it again directly. America brought the first results of systematic experiments on animals.

It is owing to Crile, Marine and Lenhart that the first deep insight was made into the morphological basis of the physiology of the thyroid gland. To these, further experiments of de Ligneris were joined, which were successfully continued by de Quervain and his pupils.

Sixteen years ago I tried to build up again the whole structure of the physiology and the pathological—physiology of the thyroid gland based on the experiments on animals. One part of the results of these experiments, the question of iodine, I have the honor to place before you now.

You know very well the opinion of physiologists about the importance of iodine for the thyroid gland and also the interesting history of the treatment with iodine.

Again to America belongs the merit of having taken the decisive step in this most important question. The works of Wilson, Plummer, Boothby, Scott and others have reached the highest point in the teaching of the therapy of the thyroid diseases.

The iodine therapy of hyperthyroidism was already known to Basedow and Trousseau. First with deliberation it was performed by the German authors, Neisser, Loioy, and Zondek. In a large style America used this therapy.

Iodine, that remedy so much feared in goiter, that three times feared medicine in hyperfunctional conditions of the gland, has just under these conditions become a miraculous remedy!

This is such a revolutionary and also such an incomprehensible fact that the explanation by means of experiments on animals seemed to be a useful work. Let us review these experiments.

If we remove half the thyroid gland of a normal dog, in the course of weeks and months we shall find that the other half grows larger. This is only the confirmation by experiment of old clinical experience.

If we look at the remains of the gland some months later we shall see a normal histological picture; that means we shall find a eutrophic view of the cellules, to use Aschoff's expression and a change of the colloid contents. But if we remove the second part of the gland only a few days later, and if we observe the histological structure of this part, then we shall see a distinct difference between that and the first half that we removed. In the second part no colloid is to be seen.

But if we give the animal thyroid substances with his food beginning from the day of the removal of the first part, the histological view is quite the same; there is again colloid in the gland.

That is a fundamental experiment. Let us make a new one. We shall make a

stricture of the trachea of a normal dog with a silk thread. Then we make a trial excision of the gland; some days later we remove the gland and examine it histologically. We shall see that the follicles are quite full of colloid. This second fundamental experiment was first made by the two German surgeons Blauel and Reich. So we can bring out by the first order of the experiment, diminution of colloid, by the second arrangement, increase of colloid in the gland of the animal.

If we now make both arrangements at the same time, that means, if we make a stricture of the trachea and a resection of the gland, the histological picture remains almost normal. To create a better understanding I have described the condition of colloid *diminution* as "hyperrhoe" and that of colloid *increase* as "hyporhoe."

If we try to bring to one formula these effects of the experiments we can say: The quantity of colloid stands in relation to the need of secretion in the organism.

Increased flow of secretion leads to diminution of colloid in the gland, obstructed flow leads to increase of colloid. We must consider the colloid as a reserve material of the gland.

Now what happens when iodine is given to the animal? If we give iodine to that animal which is obliged to retain colloid by the stricture of the trachea, then the hyporhoe is not to be seen.

If we give iodine to the animal that is obliged to reject the colloid by a resection of the gland then the hyperrhoe is not to be seen. Therefore in every case iodine works against the functional direction, *entgegen der funktionellen Richtung*, of the gland.

These are the results of experiments on animals. It is amazing how simply these experiments explain clinical observation!

You all know the picture of iodine therapy. A patient with a diffused symmetrical goiter, that means a functional one, is ordered to take iodine. Some time later symptoms appear which are very similar to those of Basedow's or Graves' disease. The goiter becomes smaller. But the symptoms which we understand as hyperthyroidism, can reach a very disquieting point. And now the remarkable thing occurs: The iodine is stopped by the physician, the symptoms of hyperthyroidism diminish, and the goiter returns. What happened? The hyporhoic goiter has been mobilized. As in the experiments on animals, the iodine worked against the functional direction which had the tendency to retain the colloid. In the organism, whose need of secretion made the hyporhoe, this retention of colloid is overcome by force. The organism responds with the symptoms of the overloading of secretion.

But as soon as the supply of iodine is stopped the original functional direction of the gland appears again; it again retains colloid, the symptoms of hyperthyroidism disappear, the goiter increases. And now we take the contrary. By a physical trauma, by an endocrine disturbance, a gland is brought into the state of hyperrhoe. The clinical view of this state is hyperthyroidism, Graves' disease. Now this patient gets iodine. In a few days the acute symptoms of hyperthyroidism disappear. But if we stop the supply of iodine, some days later the old symptoms return with renewed violence. What has happened now? Just as in the animal experiments the functional direction of the gland, which was hyperrhoe has been changed by iodine to the contrary. By that the excess of secretion was stopped, the hyperthyroid symptoms disappeared.

But as soon as the supply of iodine is stopped, the original functional direction gets the upper hand again, the retained secretion is washed away, the hyperthyroid symptoms appear again with renewed violence. A long time ago the histological examination of human goiter proved the correctness of this opinion.

Already in 1927, the two Americans, Giodarno and Caylor,[1] showed that the

[1] Giodarno and Caylor. *Surg. Gynec. & Obst.*, 1927.

amelioration of the hyperthyroid symptoms appear at the same time as the increase of colloid in the gland. Since then the works of Rienhoff, Jr., of Baltimore, Schurer of Vienna, Merke of Basle have given incontestable confirmation of this fact. Following the method of Boothby and Plummer, supplying iodine to patients with hyperthyroidism, causes an increase of colloid in the gland, which proceeds simultaneously with the amelioration of the clinical symptoms. That is the effect of iodine in hyperthyroidism, that is the essence of this bold and ingenious idea.

My report of the iodine question reaches as far as this in animal experiments; and, it is a matter of course that, with all this, not all the details of clinical observation are thoroughly cleared up. But the experiments on animals should serve to find out a broad line. The jungle of problems in the pathology of the thyroid gland should receive at least one path. Then the farmer must come and make the road passable and do the other things that belong to the work of the farmer.

But you must allow me just another word, because for all facts we must think out a reason. We can only believe that the effect of iodine lies in the influence of the secreting nerve of the gland.

We owe to the pharmacologist H. H. Mayer and to the internist Jannuschka of Vienna an interesting confirmation. Iodine can work in an organism as a sedative or as a stimulant. When in an organic system, under normal conditions, the sympathetic and parasympathetic systems are well balanced, then the functional disturbances appear by the overweight of one part of the system. In the thyroid gland the irritation of the sympathetic system leads, as Susani of Vienna shows, to hyperrhoe, irritation of the parasympathetic system to hyporhoe, now iodine always works in the direction of the normal condition.

In our case the iodine calms at once the increased tonus of the sympathetic system, by which the hyperrhoe is stopped.

With this effect of iodine on the different forms of goiter and on its clinical symptoms, the condition is brought nearer to our understanding. It is easy to consider the whole pathology and pathological physiology from this point of view. A new but perfectly enclosed and logical system is the result.

The particular forms of struma do not stand next to one another, without contact and quite strange to each other. Everything is a living chain of reversible proceedings but not a cabinet of minerals all neatly labelled!

We see the functional types of goiter as symptoms of disturbances of the whole organism. The reason for these disturbances can be exogenous or endogenous. We see the single goiter as a distinct functional phase which we diagnose before we have the preparation in our hand.

We see the prognosis of the single case in the light of its functional nature and take our therapeutic measures accordingly, and we meet the old specter of relapse with a sure hand because we know his nature. The appearance of the goiter of puberty, the adolescent goiter, the struma premenstrualis goideuhain, the goiter during the time of pregnancy and climacteric Basedow, all these are to be understood in their substance by the new method.

We understand a biography of the normal gland in the same way as a pathography of the altered gland. From these two we form a biology of the organ so that this organ with all the qualities of its life is in the grasp of our understanding.

I do not need to lay stress upon the fact that this system too has its limitations, as has all knowledge of natural science.

But the aim and end of our work is to make all our facts accessible and useful.

It is very agreeable to me to lay stress upon the important pioneer work done by the American Research Society on the solution of goiter problems. And at the end of an address about animal experiments in goiter studies, I may point with special pleasure to George W. Crile, the father of these experiments.

THYROIDECTOMY IN THE MENTALLY DISTURBED WITH EXOPHTHALMIC GOITER

WITH REPORT OF TWELVE CASES IN WHICH THE PSYCHOSIS WAS RELIEVED BY OPERATION*

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CINCINNATI

THE mental condition of patients with exophthalmic goiter is, as a rule, far from normal; yet we seldom associate the presence of frank psychoses with diseases of the thyroid gland. It is well known, however, that persons with Graves' disease are generally emotionally "on edge;" that they are easily startled, annoyed, or brought to tears or anger; and that they are likely to suffer from insomnia and spells of depression or excitement.

During the last five years, my experience with goiter surgery in mentally unbalanced patients has led me to believe that, when a frank psychosis coexists with exophthalmic goiter, thyroidectomy offers a fair prospect of relieving the mental disturbance. I have had occasion to operate upon 14 insane patients with Graves' disease, and all but 2 of them made complete mental recoveries and have remained normal to date. To this work I shall refer later.

Twenty years ago Berkley and Follis[1] observed a marked resemblance between the symptoms of exophthalmic goiter and those of the catatonic form of dementia precox. In their study of the mental symptoms occurring during the prodromal stage of catatonia, they were much impressed by the similarity between them and the mental peculiarities of patients with Graves' disease. They pointed out that in the somatic realm tachycardia, rapid loss of weight, excessive sweating, a fine tremor in the fingers, quick pupillary reflexes, vasomotor weakness and

menstrual anomalies are common symptoms in both exophthalmic goiter and catatonia.

The thyroid gland itself was observed to show rather constant changes in cases of catatonia. Although it was generally not enlarged, it was usually of a peculiar soft and mushy consistency and contained occasional hard nodules. When iodine, iodothyrine or desiccated thyroid extract was administered to patients with dementia precox, they came out of their stupor temporarily.

Berkley and Follis performed partial thyroidectomy in 10 cases of catatonia. As a result, 4 of the patients recovered their mental equilibrium, 3 of them improving slowly but progressively and showing no tendency to relapse.

Other investigators have confirmed the work of Berkley and Follis, so that there can be no question but that, in occasional cases, there is a close relationship between dementia precox and thyroid disease. Of course, it must be distinctly understood that no attempt is being made to assign an etiological relationship of the thyroid gland to the average case of dementia precox; for the mass of evidence is opposed to this view.

Kanavel[2] observed definite improvement but not complete cure in a case of dementia precox of recent standing in which he removed the thyroid gland. However, in 9 cases of long standing there was no mental improvement following the operation.

* Read before the American Association for the Study of Goiter, Denver, June 18–20, 1928.

Winslow,[3] in a series of 5 cases of dementia precox in which partial thyroidectomy was performed, noted much improvement in 3; but 2 of the patients later relapsed. He concluded that there is apparently some relation between the thyroid gland and catatonia; that partial thyroidectomy frequently confers great benefit, when the operation is performed in the early stage of the disease; but that thyroidectomy late in demetia precox is without benefit.

Weinberg[4] noted complete relief of the mental symptoms after thyroidectomy in a case of dementia precox and one of manic-depressive psychosis, both with typical symptoms of exophthalmic goiter. Eastman and Eastman[5] performed hemithyroidectomy in 4 cases of the paranoid form of dementia precox in which one lobe of the thyroid gland or one lobe with the isthmus was enlarged. In each case the psychosis was entirely relieved. Jackson[6] observed recovery after operation in a mentally disturbed woman with typical symptoms of exophthalmic goiter. Boys[7] reported 8 cases of goiter associated with well-developed mental symptoms, in 6 of which thyroidectomy resulted in complete recovery.

My own experience with thyroidectomy in cases of combined exophthalmic goiter and mental disease has been exceedingly favorable. As I have already stated, 12 of 14 frankly insane patients upon whom I operated for Graves' disease during the last five years made complete mental recoveries and have retained a normal mental status to date. Two of these patients were young subjects, in whose cases diagnoses of dementia precox had been made and poor prognoses given; yet both recovered. In 13 cases the condition of the thyroid gland was hyperplastic goiter; in 1 toxic adenoma also with some evidence of hyperplasia.

I should like to mention 2 of my cases as typical of those with favorable results in this series. I saw a woman, thirty-five years old, at the Connecticut State Insane Asylum, Middletown, Conn., who had lost 40 lbs. during the preceding six months. Her pulse was very weak, ranging between 140 and 160. The outstretched fingers showed a very pronounced fine and rapid tremor. There was an adenoma about the size of an egg over the right lobe of the thyroid gland, which was enlarged and of the consistency usually found in hyperplastic goiter.

During the journey to Cincinnati, the patient kept muttering unintelligibly and made several attempts to leave the train. On several occasions she tried to swallow her own feces. She improved physically under rest and Lugol's solution, but her mental condition remained the same. Thyroidectomy was performed and the postoperative course was uneventful. At the end of a month her weight had increased and her pulse rate was normal. Later her mind began to clear and three months after the operation she appeared mentally normal. A month later her mental condition was so satisfactory that she was allowed to make a motor trip East by herself. She has now been under observation for a year and is entirely well and there is every reason to believe that she will remain so. I believe that her mental disturbance was of the nature of an exhaustion psychosis and that thyroidectomy, by eliminating the source of toxemia, played a large part in restoring mental balance.

The second patient was a married woman, thirty years old, whose mental symptoms suggested the paranoid form of dementia precox. At times her behavior was very strange. Once she left home and was found late that night wandering aimlessly in a nearby woods. She refused all forms of medication, particularly when her husband tried to give it to her, because she imagined that an attempt was being made to poison her. She had a number of delusions of persecution, but they were in the main poorly organized, as is characteristic of the paranoid form of dementia precox.

For four years she had noticed that her

neck was unusually full. During the previous year the swelling had increased. At the same time, she became more irritable and emotional, until finally her conduct began to appear decidedly abnormal. Her last child was born fourteen months previously, and she had lost 20 lbs. since that time.

The appearance of the patient was typical of thyrotoxicosis. She was excited, apprehensive and considerably under weight. Her pulse rate ranged between 130 and 140, and the thyroid gland was increased to about three times normal size and was of the consistency found in hyperplastic goiter.

During the first week after thyroidectomy, which was performed after the usual course of preparation with Lugol's solution, the mental symptoms became worse. Frequently the patient became so excited and uncontrollable that hypnotics were required. Twice she ran away from home. Three months after operation, however, it was apparent that gradual improvement was on the way. At the end of a year, during which improvement was slow but steady, the patient appeared entirely well and her mental condition was clear in every respect. She has remained well both mentally and physically, and there is no reason to believe that she will relapse.

In 10 other mentally disturbed patients upon whom I operated for exophthalmic goiter the mental symptoms finally disappeared after thyroidectomy. In 2 cases there was no benefit from the operation. One of these patients died in an asylum and the other is still an inmate.

Experience in the treatment of mental diseases has proved that anything which improves the general health of the body increases the likelihood of recovery from the psychosis. Exophthalmic goiter is in itself a cause of much nervous instability and unrest. Given a person of the schizophrenic type, it may well serve as an exciting cause of mental breakdown. I do not believe, however, that exophthalmic goiter is related to dementia precox or other psychoses, other than as a precipitating and contributory cause.

In performing thyroidectomy on patients with psychoses, it is doubly important to insist upon preoperative rest and treatment with Lugol's solution, because of the danger of increasing the mental symptoms by a period of exacerbation that might otherwise follow immediately after the operation. Furthermore, in patients with mild psychoses, we must be prepared to exercise restraint, if necessary. Mental betterment seldom occurs immediately after thyroidectomy but is more commonly of gradual evolution during a period of from several months to a year.

In conclusion, I should like to emphasize the fact that the coexistence of mental disease with exophthalmic goiter does not constitute a contraindication to operation but rather makes thyroidectomy doubly advisable, since it offers a fair prospect of mental recovery.

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THE TREATMENT OF THE DESPERATE GOITER PATIENT*

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THE mortality and morbidity following operations for toxic goiter are now fairly good in patients with moderately toxic goiter showing no extraordinary symptoms or pathology. The great difference between the mortality and morbidity rate of surgeons obtaining the best results and those obtaining only mediocre results is usually in the so-called desperate goiter patients. This paper will discuss the following: 1, severe hyperthyroidism without crisis; 2, hyperthyroidism with crisis; 3, hyperthyroidism with fibrillation; 4, hyperthyroidism with extreme hypertension; 5, hyperthyroidism in pregnancy.

1. Severe hyperthyroidism without crisis. It would seem that with the use of Lugol's solution as suggested by Plummer and of the preparation of the patient for operation as emphasized by Crile, the mortality should be low, yet it is not as low as it should be. The chief cause of mortality and morbidity in this group is lack of preparation before operation. The patients are operated upon before they are ready and death is the result. The master goiter surgeon may be able to judge when the patient is ready for operation without laboratory assistance, but the mass of surgeons operating upon goiter cannot, and death often results in their attempt to imitate the master by disregarding such aids. While the master goiter surgeon by his skill may be able to tell when the severely toxic patient is ready for operation, he cannot by his skill so accurately distinguish between the mildly toxic goiter and other conditions which so closely simulate it that only the basal metabolic rate will differentiate. Neither can he by his skill so accurately distinguish between the patient requiring stage operations and the one who does not, so he treats all as severe cases. There is no surgeon so skilled that he can differentiate as well without laboratory aids as with them, and the surgeon who does not use laboratory aids either subjects some of his patients to unnecessary delay with unnecessary stage operations, or has an operative death-rate higher than it should be.

Patients with severe hyperthyroidism should be sent to the hospital for preparation. It cannot be done well at home. Patients should not be permitted to get out of bed for anything or consulted about any matters pertaining to business or other responsibilities. Lugol's solution should be given in amounts varying from 10 minims three times a day to 25 minims four times a day according to the severity of the disease. Nervousness should be controlled by giving 5 to 10 grains of veronal in hot milk every night at 9 o'clock as routine, and additional veronal or pantopon if needed to make the patient perfectly contented. The diet should be watched, with selection of food that the patient likes and can digest easily, and eggnog, milk or chocolate should be given between meals. We make it an absolute rule never to do a radical operation on such a patient with a basal metabolic rate over plus 50; under plus 40 is preferable and even then we do not operate until the patient's symptoms show a very definite improvement. Further, it is an absolute rule never to operate upon such a patient if he is apprehensive of the result. I do not believe in the so-called stealing of the goiter. With the judicious use of sedatives, Lugol's solution, a carefully forced diet

and proper nursing, these patients instead of being apprehensive are anxious for the day of operation to come. In the occasional patient who cannot be satisfactorily prepared by this method, the stage operation is indicated but as time goes on and experience becomes wider, we find fewer patients in this group who require the operation in stages, so that now it is a rare thing for us to do a ligation of the superior pole and almost as rare to remove the lobes one at a time.

2. Hyperthyroidism with crisis. Crisis occurring in severe hyperthyroidism is probably due to an acidosis. The markedly increased catabolism necessitates increased excretion and an increased dissipation of heat. The blood supply of the skin is increased in order to hasten the dissipation of heat through radiation and evaporation. The rapid evaporation reduces the fluids of the body concentrating the solids of the blood stream and making their absorption from the tissues more difficult. The increased blood supply to the skin means a relatively decreased blood supply to the kidneys, consequently, these patients are prone to develop an acidosis. Until we began to use glucose intravenously we had a limited number of patients each year coming in with an acute hyperthyroidism with vomiting and diarrhea which we were unable to control, and consequently, we were unable to give Lugol's solution because it was immediately expelled when given by either mouth or rectum. These patients usually died within two to four days after entering the hospital. Since we began to use glucose intravenously, I have not seen a single death from this cause. With the exception of patients brought in in a morabund condition this type of death should be extremely infrequent. It is our custom in this group to give patients 1000 c.c. of a 10 per cent solution of glucose in physiologic salt solution intravenously as soon as they enter the hospital. This is given slowly, taking at least an hour for administration and longer if there is evidence of myocardial weakening. Fifteen units of insulin are given at the beginning of the injection of the glucose and the same amount at the conclusion. The vomiting and diarrhea are rapidly checked and the patients are then able to take Lugol's solution by mouth. We prefer giving the Lugol's solution in orange juice or milk in 25 minim doses four times a day. After checking the crisis, the preparation of these patients does not differ from that of those with severe hyperthyroidism without crisis except that it usually takes a little longer to get them ready for operation.

3. Hyperthyroidism with cardiac fibrillation. This group gives us more anxiety than any other group of goiter patients and yet our results are as satisfactory so far as operation is concerned. I have had only 1 death to be termed an operative death in this group and that in a woman seventy-nine years of age. Other patients have later died of heart lesions but this did not occur for some time after leaving the hospital with the exception of 1 patient who died from emboli one month after leaving the hospital.

These patients are put at absolute rest in bed. Veronal and pantopon are used in sufficient dosage to keep them perfectly contented. Lugol's solution is given as to patients with severe hyperthyroidism. The heart condition has been treated by my associate, Dr. Luther T. Nelson, with quinidine, or quinidine and digitalis. Some of the milder cases yield with this treatment and the heart stops fibrillating, but in some of the more severe cases, the heart continues to fibrillate until the final subtotal lobectomy.

It is in this group that the stage operation is most valuable. Upon those patients in whom the heart does not yield, the operation is done in four stages; ligating the superior poles one at a time and doing the subtotal lobectomies one at a time. I have many times observed that while the patient showed definite improvement after each of the stage operations, the heart continued to fibrillate until the

removal of the last lobe. This is indicative of the extent of the operation required. Practically all the diseased thyroid tissue must be removed and new thyroid tissue developed in order to get a normal secretion. Even though the heart may appear to be normal, the patient should be warned that a badly damaged heart probably never becomes completely normal and consequently should never be severely taxed.

4. Hyperthyroidism with hypertension. Hypertension occurs in the course of hyperthyroidism from toxic adenoma or toxic diffuse adenomatous goiter and after repeated attacks of toxic hyperplastic (exophthalmic) goiter. Patients with pronounced hypertension have given me a great deal of anxiety for fear a cerebral hemorrhage would occur as a result of the operation. Up to the present, I have never seen it follow goiter operations, although I saw it only last year following a prostatectomy that was necessary in the presence of high hypertension because of marked urinary retention.

.It is our rule never to operate in the presence of high hypertension except in case of necessity. I regard operation in toxic goiter with hypertension as a necessity because these patients gradually get worse. They are given bed rest with sedatives and Lugol's solution for one to two weeks previous to the operation. Ligations are rarely done, as the type of goiter producing hypertension usually does not give definite results from ligating the superior poles. Subtotal lobectomies are done in one or two stages according to the severity of the goiter and the height of the hypertension. Following the operation the hypertension usually is reduced but rarely returns to normal because of permanent damage done before operation.

5. Hyperthyroidism in the latter months of pregnancy. In the early months pregnancy does not constitute a contraindication for an operation for goiter. In fact, I have regarded it as an indication for an immediate operation because the patient with a mild hyperthyroidism may develop a very extreme hyperthyroidism in the course of the pregnancy. I have never seen an abortion occur as the result of the operation on a pregnant woman. In the latter months of pregnancy there is an added risk and I believe it is best to treat these patients with roentgen ray, telling them that it is a temporary measure. While it relieves the attack, it does not cure the goiter, which will recur later in a large proportion of the cases. It is my custom to give these patients Lugol's solution, the amount varying from 10 minims three times a day to 25 minims four times a day for two weeks. Sedatives are given to control the nervous state of the patient and each lobe and the isthmus are given 90 milliampere-minutes of roentgen ray, 3 milliamperes of current for thirty minutes, with a 9 inch back-up, filtered through 6 mm. of aluminum and ½ inch of sole leather. This is repeated as indicated; usually only one treatment is given and the patient is advised to come in a month after delivery for the operation.

The operation done in severe cases must be radical. Recurrences and, what is more common, continuation of symptoms with only partial relief and which later become severe, are more common with incomplete operations upon this group than in the mild goiters. The entire thyroid gland is diseased in all except the isolated adenoma. The types I have been discussing are usually caused by the diffuse types of goiter. The patients belong to the desperate goiter group because of the severity of reaction to the secretion of a pathologic gland. A partial operation that leaves sufficient pathological gland to continue to produce the secretion does not cure. The operation must be so radical that were regeneration not to take place, myxedema must result because of a lack of secretion.

In experimental work I have demonstrated that regeneration with the development of normal thyroid tissue sufficient to meet the needs of the experimental

animal will take place if the gland is saturated with iodine and kept saturated for two months after the operation. In practice, I give 10 minims of Lugol's solution three times a day for one month after the operation and then once a day for the second month, and follow this with iodized salt or 10 mg. of iodine weekly in tablet form. I have never seen a recurrence when this method has been followed. Sometimes there will be a transitory hypothyroidism as a result of the radical operation but this is easily controlled with desiccated thyroid in small doses and has always cleared up, in patients I have seen, within one to three months.

Experimentally we have demonstrated that without the pre- and postoperative saturation of the thyroid with iodine, excessive hyperplasia with true goiter development may occur.

In conclusion I wish to state that in my judgment, with careful study and careful handling before the operation, the desperate goiter patient does not offer a much greater risk than the milder case so far as the cure of the goiter itself is concerned. However, permanent lesions existing before the operation will still be present so that many patients will still have some of the effects of the severe goiter although the toxic goiter has been replaced by a thyroid gland with a perfectly normal secretion.

THE RELATION OF GOITER TO OTHER ENDOCRINE GLANDS*

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NATURALLY only the high points in such a discussion can be touched upon in a paper of this kind. Let me say in the beginning that there is considerable doubt in my mind as to whether exophthalmic goiter is a disease of the thyroid. A few reasons for this attitude are as follows: We cannot accurately correlate thyroid pathology and goiter symptomatology, that is, the clinician cannot foretell from the symptoms and the preoperative physical and laboratory findings what the pathologist will find when the gland is removed. And the pathologist cannot tell from the section what symptoms the patient may have exhibited. Most of the symptoms of Graves' disease may be present without goiter. The fact that many patients are relieved of most of their symptoms by removing most of their thyroid tissue does not prove that the thyroid is the only, or even the chief, factor at fault in this syndrome. This post hoc, ergo propter hoc line of reasoning has very little standing in the scientific world outside this particular field. Our ignorance of the etiology and pathogenesis of Graves' disease is almost as complete now as it was two decades ago.

Perhaps the easiest way to go about such a discussion as this will be to take up the various glands most intimately related to the thyroid and to try to find out how much we know about this relationship, how it affects the etiology, symptomatology, prognosis and treatment of goiter, and what we can do about it, if anything.

The pituitary, the parathyroids, thymus, adrenals, gonads, and the pancreas are the glands most intimately related to the thyroid.

THE PITUITARY

Embryologically the relationship between the anterior lobe and the thyroid is very close. This relationship is probably continued in a functional way throughout life. The anterior lobe is formed from a mass of epithelium split off from the pharynx just as is the thyroid. But in the male a larger mass goes to the pituitary than goes to form the thyroid, while in woman the reverse is true. Is this of any significance? The majority of toxic goiters, especially the exophthalmic variety, occur in women. Eason[1] says most of these occur in women of narrow frame, of light skeletal structure with associated narrow subcostal angle and enteroptosis, individuals whose structure would make one think perhaps the anterior lobe of their pituitary had not been sufficiently active during their prepubertal years. It rarely occurs in men of strong rugged frame, showing evidence of an anterior lobe very active during the developmental years.

In acromegaly, which is presumably due to hyperfunction of the anterior lobe, the thyroid, parathyroids, adrenal cortex, and gonads show hyperplasia. Presumably, the opposite is true. That is, in Simmonds' disease the same structures show some degree of atrophy. Cushing[2] says in states of pituitary deficiency these particular glands are found to be atrophic.

THE PARATHYROIDS

The parathyroids are of great interest to the thyroid surgeon because of their intimate anatomic relation to the thyroid. It is now conceded by every one that the parathyroids are not derived from the thyroid. A good many patients following

thyroidectomy show some signs of parathyroid insufficiency. These symptoms are not usually due to the removal of the parathyroids, but because their blood or nerve supply has been interfered with, either at the time of operation or by scar tissue formation. It is important that such cases be promptly recognized and properly treated. The gland may be sufficiently active to perform its function during ordinary strains and only show signs of insufficiency during unusual stress as during the menstrual periods or pregnancy or when the patient becomes constipated. It is probable that the parathyroids bear somewhat the same relation to calcium metabolism that insulin does to carbohydrate metabolism and that in the presence of a severe degree of parathyroid lack, the body is unable to utilize calcium even when it is present in sufficient quantities. In such cases, it is necessary to use the parathyroid hormone for a time. The body eventually accustoms itself to the loss of much, if not all, of its parathyroid tissue. During this period of treatment or readjustment the patient should be given considerable doses of calcium and should be kept on a low proteid diet. The use of citrus fruits is helpful. Calcium should be given in large doses. It is most conveniently given as the lactate in doses of 1 dram t.i.d. in a glass of water with lactose drams 3. Luminol in doses of 1 to 1½ grains t.i.d. is helpful in allaying the nervous disturbances. The calcium is many times more effective if given intravenously, using a solution of the chloride or glucocalcium. This method can usually be stopped after a few days.

THE THYMUS

For a long time pathologists have known that thymus tissue existed in some quantities in toxic goiters, especially the exophthalmic variety. Hypertrophy of the thymus and hyperplasia of the lymphoid tissue generally are characteristic of Graves' disease. The lymphocytes show a relative and absolute increase in exophthalmic goiter. It has been suggested that in cases showing a hyperlymphocytosis, operation is a dangerous procedure. Consequently a white and differential cell count should be made before operation. Careful physical and roentgen-ray examination should be made to discover if an enlarged thymus is present. If found, it should be properly radiated before thyroidectomy is done. It is not beyond the range of probabilities that cases showing the greatest improvement under roentgen-ray therapy are those having considerable amounts of thymus tissue. The fact that such enlarged glands have not been noted does not rule out the likelihood of their presence.

THE ADRENALS

Adrenaline heightens the effect of sympathetic impulses and exaggerates the symptoms of Graves' disease. On this basis Goetsch built his test for hyperthyroidism. This is probably of greater negative than positive value. While many persons respond positively to it who do not have Graves' disease, cases that do not respond to it are undoubtedly not cases of Graves' disease. The administration of adrenaline by mouth to a patient having Graves' disease will usually produce a gastrointestinal upset. The more severe the symptoms of Graves' disease, the more easily is this upset produced.

The Adrenal Cortex. The only time exophthalmic goiter has been produced experimentally was by damaging the adrenal cortex. Using rabbits, because they are the only experimental animals having sufficient accessory adrenal tissue to withstand double adrenalectomy, Marine and Baumann[3] were able by removing both adrenals and so producing sublethal damage to the adrenal cortex, to reproduce all the symptoms of exophthalmic goiter, including exophthalmos and goiter. There was tremor, tachycardia, weakness, loss of weight and strength, increased nervous instability, increased heat production, hypertrophy of the thymus, hyperplasia

of the lymphoid tissue and increased sensitiveness to toxins.

Following this work, Shapiro[4] used an emulsion of fresh adrenal cortex in glycerin in the treatment of Graves' disease. He regards it as a valuable remedy though by no means a cure-all. It is possible that we shall find eventually that many of the symptoms of Graves' disease are due to insufficiency of the adrenal cortex. One sees some cases exhibiting the usual symptoms of Graves' disease but having neither goiter nor an elevation of the basal metabolic rate. It is possible that these are cases of adrenal cortex insufficiency. Treatment along the line suggested by such an idea produces very satisfactory results, whereas if these cases are allowed to proceed untreated, they finally develop the typical picture of Graves' disease. The' number of such cases in the literature is increasing.

THE PANCREAS

There are certain striking resemblances between diabetes mellitus and Graves' disease;[5] liver glycogen is deficient in both, tissue storage of carbohydrate is deficient in both, nitrogen excretion is excessive in both, blood sugar is excessive in both, carbohydrate tolerance is reduced in both, glycosuria is fairly constant in diabetes and occasional in Graves' disease, emaciation is constant in both, the appetite is good, even excessive in both, the conversion of sugar to glycogen is defective in both, the respiratory quotient is low in both.

Insulin is of some value in the treatment of Graves'; it tends to keep the temperature near normal. By giving relatively small doses with glucose, the advantages to be derived may be summed up as follows:

1. The intermittent loss of sugar is prevented.

2. More sugar is available for withdrawal to the tissues for storage.

3. The excessive combustion of sugar, due to the action of thyroxin and adrenaline, is restricted, an adequate store of glycogen is maintained in the liver.

4. The tissue starvation of carbohydrate and phosphorus and possibly of amino acids is diminished.

5. The function of the liver in forming glycogen from fat and proteid under the stimulus of thyroxin is controlled.

6. The protein and fat-sparing function of insulin diminishes ketosis and possibly diminishes the amount of fat in the liver.

There are no special risks in using insulin in the treatment of Graves' disease. The body shows a decreasing tolerance for it so that the dose has to be cut down after a few weeks or the amount of glucose given with it needs to be increased. The latter is the better procedure as by this the weight of the patient may be maintained or even caused to increase.

THE GONADS

There has been much discussion among endocrinologists as to whether the thyroid and the gonads were synergists or antagonists. In the present state of our knowledge it is impossible to settle this question. The following facts are significant. The thyroid has a stimulating while the gonads have an inhibiting effect on the growth of long bones. Thyroid insufficiency is accompanied by a considerable tendency to obesity. This is absent or much less marked in primary hypogonadism.

Graves' disease is much more common among women than among men. The ratio being variously estimated at from 5:1 up to 10:1. This is during her most active sexual life. After the menopause the ratio sinks to 3:1. More cases of myxedema in women occur after the menopause than at any other time.

The intimate relation of the thyroid and the ovaries is suggested by the term "uterus of the neck" which is sometimes applied to the thyroid. Colloid goiters make their appearance at puberty. The thyroid enlarges during the menstrual periods and pregnancy. During pregnancy the B.M.R. is usually elevated 10 to 20

per cent. Women having adenomas without hyperthyroidism frequently feel better during pregnancy than at any other time. On the other hand adenoma without hyperthyroidism that may have been present for many years becomes active at or near the menopause.

Enlargement of the thyroid occurs in animals from which the ovaries have been removed. Eason[1,6] says the female is predisposed to thyroid disorders. But hyperthyroidism seldom occurs in either sex until the adult development of the genital and interstitial cells has been attained. At puberty the thyroid becomes larger and more vascular, contains more iodine and shows evidence of greatly increased activity. Such signs are much more common in the female; while in the male the neighboring organ, the larynx becomes enlarged.

Quoting Eason[7] again, he says:

At this stage, i.e., puberty, the growth of the thyroid gland seems to be stimulated by the endosecretions of other glands. Of these the interstitial cells of the ovary and testis are the most important (by their action either directly on the thyroid or indirectly by nervous and mental processes).

Many simple goiters show signs of activity at this time and there is little question but that many are needlessly removed. There are some signs of hyperthyroidism associated with these enlargements, but the basal metabolic rate is usually near normal. The proper exhibition of some form of ovarian medication seems to produce satisfactory relief of these symptoms.

Severe degrees of hyperthyroidism are usually accompanied by considerable disturbances of the menstrual function or even by amenorrhea.

The menstrual history of a woman having hypothyroidism is characterized by the early onset of the menstrual periods, their regularity, profuseness, and freedom from pain. She usually begins to menstruate at an earlier age and continues longer than the woman having signs of hyperthyroidism.

Finally, in examining goiter patients let us not focus our attention entirely on the thyroid or on symptoms that in our present knowledge are believed to arise as a result of its dysfunction. Let us not forget that the patient has other endocrine glands besides the thyroid and that some of these may not be functioning properly. The recognition and proper treatment of these disorders will at least not delay the patient's recovery.

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INJURIES TO THE PARATHYROIDS
& SUBSEQUENT MANAGEMENT*

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A COMPREHENSIVE discussion of the parathyroid glands, calcium metabolism and tetany is beyond the scope of this paper. The voluminous literature embracing the development of our knowledge of these related subjects has been exhaustively reviewed and is easily available. Conspicuous among these is a monograph by Boothby which was published in 1922. Since that time the story of the epoch-making work of Collip, in his isolation of the calcium-raising hormone, has been added to the literature. Very recently Dragstedt has reviewed the conflicting theories of the function of the parathyroid glands and summarized the evidence for and against each of these in the light of his extensive animal experimentation. From these sources, with their complete bibliographies, reliable references may be had to the best that has been thought and the most that is known concerning the parathyroid glands. In this discussion the subject is necessarily limited to the concrete problem of accidental injuries occurring at time of operation with specific emphasis on the treatment of their sequelae.

One of the serious complications of thyroid surgery is some type of injury to the parathyroid glands. Damage to these important adjacent structures may consist of their complete removal along with the thyroid. It has also been reported that they are sometimes injured by the grasp of a hemostat or by some direct interference with their blood supply. From the gradual and delayed onset of symptoms it is believed that they and their blood supply are rarely injured by the encroachment of scar tissues. Whatever the nature of the injury, it seems well established that when two or more of these glands are rendered functionless, parathyroid tetany occurs.

Fortunately, improvement in surgical technique and a more general appreciation of the possibility and seriousness of such an accident have reduced the percentage incidence of parathyroid tetany following thyroidectomy; but the enormous increase in the total number of thyroidectomies performed, the recognized necessity for secondary operations in recurring types of toxic goiter and the occasional indication for radical surgery at any cost continue to produce more than a negligible number. While complete and authentic statistics of its incidence are not available, surgeons doing an enormous amount of goiter surgery have reported that parathyroid tetany occurs following $\frac{1}{10}$ to $\frac{1}{2}$ of 1 per cent of the thyroidectomies done. It is probable that this difference of incidence is more dependent upon the failure of some surgeons to report cases of mild and transient tetany than upon differing operative procedures. But mild or severe, transient or permanent, it still occurs often enough to demand further prophylactic efforts.

The problem of prevention is purely a surgical one, which can well be left to the surgeon. It is questionable, however, whether the percentage incidence of parathyroid injury can be expected to be appreciably reduced by further surgical caution based on the conventional understanding of the anatomy of these structures. It is well to recall that the parathyroid bodies are relatively small glands firmly attached to the thyroid capsule. While they have characteristics which some anatomists contend make them

"easily recognizable" this is not true under the well known conditions that prevail during an operation. While it is known that, as a rule, the two pairs of glands have a characteristic relation to the thyroid and its arteries, anomalous positions do occur. Besides, these tiny structures share with the thyroid a common blood supply. Under these anatomical conditions and with the occasional necessity for radical and secondary operations, the wonder is not that they are sometimes injured, but that they are almost always spared.

For many years surgeons have advocated reimplantation of parathyroid tissue, if, during the course of an operation, it is discovered that such tissue has accidentally been removed. Millzner, Terry, and their associates have recently demonstrated that anomalous parathyroid tissue may frequently be found on the anterior capsule which, they believe, if spared by the surgeon, may hypertrophy and take on compensatory function. They have also shown that by an ingenious technique this tissue may be identified in the removed thyroid and successfully reimplanted. Lahey working independently has likewise advocated a similar procedure at the operating table. It is too early to conclude the extent of its practical value but by some such procedure it is reasonable to hope for a reduction in postoperative tetany that would otherwise occur from unavoidable injury. The grafting of parathyroid tissue from other individuals or lower animals has not yet been justified by experience. The inherent difficulties encountered in heteroplastic and zooplastic grafting of other organs does not offer much encouragement when applied to the parathyroid glands. With the exception of reimplantation of identified tissue at the time of operation, successful gland grafting is still a far cry. Consequently tetania parathyreopriva still occurs giving rise to a rare but extremely difficult problem of medical management. It is the chief purpose of this paper to consider the therapeutic means now in use and to report the results of their use in the treatment of 2 patients of chronic and severe parathyroid tetany.

It is well known that this condition occurs in an acute and a chronic form. Much confusion exists in the literature in evaluating methods of treatment because of failure to separate these types. The acute or transient form comes on very soon after operation and disappears in from one to ten days with or without treatment. The parathyroid glands undoubtedly share in the postoperative edema and irritation and for this reason are probably temporarily deprived of their blood supply. This hypothesis for the cause of temporary hypofunction seems wholly tenable when it is recalled how often demonstrable swelling and irritation of the trachea follow thyroidectomy.

Treatment in such cases is very simple. In acute tetany 20 c.c. of 5 per cent calcium chloride solution is administered intravenously whenever the muscular contractions are painful and repeated when they recur. The patient gets well not because calcium or any other drug has been given but because edema of the neck structures subsides, circulation is restored, and the parathyroid glands take up their normal function. Such patients because of their transient tetany and tendency to recover without treatment cannot be used as test cases of therapeutic agents save for the demonstration of the immediate and spectacular value of intravenous calcium.

Chronic tetany is an entirely different problem. Here the parathyroid bodies or their blood supply are destroyed beyond restoration. Save for the chance of developing compensatory function of parathyroid tissue ordinarily inadequate, such a patient must come to depend upon some type of more or less regular medication indefinitely. Despite the unexplained tendency of chronic tetany to periods of activity and remissions it is this type which offers the most crucial test of treatment methods.

In 1909, MacCallum and Voegtlin demonstrated that hypocalcemia is asso-

ciated with parathyroid tetany. They further demonstrated that the injection of calcium into the blood stream in sufficient amounts immediately relieves the test animal of its tetanic spasms. They therefore concluded that the parathyroid glands in some way control the calcium metabolism, thus maintaining a constant blood level of about 10 mg. per 100 c.c. While it is admitted that there may be other functions of the parathyroids, their significance in the control of blood calcium has not been seriously questioned. Since that time calcium has been the sheet anchor in treatment. But it was soon observed that calcium salts, when given by mouth, had little to do with the blood calcium level. Diets rich in calcium and the drug in enormous amounts given preferably when the stomach is empty have been advocated but it has not been conclusively shown that any such regime raises the blood calcium appreciably in the absence of adequate parathyroid secretion. While the drug is highly successful in temporarily relieving symptoms and raising the blood calcium when given intravenously, it is *practical* only in *acute* tetany. To attempt to treat chronic tetany by such a method would demand the daily attention of a physician. It would likewise subject the patient to the constant danger of a slough at the site of injection, scars from which are the telltale marks of unwise therapy in many cases of tetany. Calcium *alone* is impractical or ineffective.

Evidence of specific effects in the substitution method of feeding desiccated parathyroid has not been convincing. Collip has more recently shown that the active extract is rendered inert by the digestive ferments. Therefore, unless there is demonstrated some active principle other than the so-called hormone of Collip, gland feeding is useless. Conflicting and inconclusive clinical evidence would also seem to substantiate this belief. A practical method of substituting for the loss of parathyroid activity, then, must be something other than gland feeding.

In 1924, Collip isolated an active extract or hormone which when given intravenously or subcutaneously causes a rise in the blood calcium of experimental animals. These definite findings are too recent and too well confirmed by others to require further comment. The hormone has been standardized in terms of units, 1 unit being one $\frac{1}{100}$ of that amount which will raise the blood serum calcium of a 20 kilo dog 5 mg. in fifteen hours. If this hormone, so active in some lower animals, is commensurately accurate in man, it would seem perfectly obvious that chronic tetany could be controlled by hormone injections much as diabetes mellitus is controlled by insulin therapy. It would seem that all we need to do is to provide an excess of calcium in the dietary and administer adequate amounts of parathyroid hormone to maintain the blood calcium between 8 and 12 mg. This adequate dosage of hormone could apparently be ascertained by blood calcium determinations much as the insulin dosage is worked out against glycosuria and blood sugar. In 1926 Collip reported 1 such case so standardized. He further reported gratifying clinical results in the hands of Crile, Lisser and others. More recently John has reported that the administration of parathormone is followed by relief in all cases of chronic tetany. To these clinical experiences I wish to add the following typical cases:

CASE REPORTS

CASE I. A. C., female, aged forty-six, was admitted to the Colorado General Hospital March 20, 1928. She had been treated for parathyroid tetany for five years. The significant part of her history is as follows: Developed exophthalmic goiter for which she had a thyroidectomy in 1916. Recovery uneventful and enjoyed fair health up to July, 1922, when goiter symptoms returned. Hospitalized for three weeks and received two radium irradiations of the thyroid. Had a ligation followed by a thyroidectomy in January, 1923. Says she began to have muscular pains and convulsions before she returned from the hospital for which she received calcium intravenously. Despite calcium and desiccated parathyroid by mouth she continued to have one or two convulsions

Chart 1, Case 1

CHRONIC PARATHYROID TETANY

Date 1928	Para-hormone	Calcium Lactate Grs.	Blood Chemistry			Notes
			Calcium	Phosphor-ous	Plasma CO_2 Combining Power	
Mar. 20	..	750	...	...	....	Had several attacks of pain. "Hysterical spells."
21	..	750	9.6	...	....	Same as previous day.
22	..	750	...	...	....	One attack in twenty-four hours. More cheerful.
23	..	750	...	...	....	Restless. Feared attacks but had none.
24	..	750	...	...	64.2	Quiet, not nearly so nervous.
25	30	300	...	...	....	Definite convulsion 7:00 A. M. Dazed after the attack.
26	30	300	...	...	....	Fair day.
27	30	300	...	...	....	A much better day. No complaint.
28	30	300	7	6.9	....	A better day. Much improved. No complaint.
29	30	300	..	...	....	Patient happy. No complaint.
30	30	300	...	...	....	Nauseated. No complaint.
31	30	300	...	...	....	Good day. Out of bed.
Apr. 1	30	300	..	...	....	Good day.
2	30	300	..	...	....	Good day.
3	30	300	...	...	....	Good day.
4	30	300	9.2	...	....	No complaint.
20	30	300	8.7	...	....	No complaint.
26	30	300	7.2	...	....	No complaint.
May 22	15	300	9.7	...	....	No complaint.

daily. During next two years frequency of the convulsions became less.

In 1925 convulsions became severe and frequent just preceding appendectomy, but subsided after operation. During the last three years her condition has shown marked improvement. Has noticed she gains weight and is free from attacks during summer months. Begins to go down in winter, loses appetite and weight and has considerable muscular pain. Convulsions become more frequent reaching their maximum about March, to subside again with the coming of summer. At the height of seasonal tetany she was admitted to the Colorado General Hospital, March 20, 1928, for study and treatment. Her subsequent history is set forth in Chart 1.

CASE II. W. H. D., male, aged thirty-eight, seen September 23, 1927. His complaint and physical findings were typical of goiter of the exophthalmic type. His family and past history were not significant. Present complaint began in 1922. First thyroid surgery was in

1925: one operation in July, another in August and a third in September of that year. His neck shows two lateral and one collar scar. Felt better for almost one year after these operations but the same type of symptoms returned in 1926. Since he received little or no relief from medical treatment he was again operated on October 14, 1927. He made an uneventful recovery save for some tingling in the skin and extremities. This new complaint persisted and by the middle of November, 1927, he was having considerable pain especially in the extremities and chest, also typical carpopedal spasms. He was given calcium and desiccated parathyroid gland by mouth without relief. Twenty c.c. 5 per cent calcium chloride gave immediate relief which lasted for three days when it was repeated with relief again. He then improved in every way for about one month, at the end of which period muscular spasms and pains returned and were uninfluenced by 20 units of parahormone plus large doses of calcium by mouth, but were relieved by intravenous calcium. His spasms showed no signs of

CHART II A, CASE II
CHRONIC PARATHYROID TETANY

Date	Para-hormone	Calcium Lactate	Blood Chemistry			Clinical Notes
			Cal-cium	Phosphor-ous	Plasma CO_2	
1928 Jan. 20	30	. .	. . . .	. . . .	. . . . . .	Very restless.
21	30	. .	6.6	. . . .	. . . . . .	Feels fairly well.
22	.	. . .	. . . .	. . . .	. . . . .	Pain in the neck, chest, back and arms.
23	. .	. . .	. . . .	. . . .	. . . . .	Pain in arms and hands.
24	. .	. .	6.2	. . . .	. . . . .	Pain in arms, kept to bed.
25	.	. . .	. . . .	. . . .	. . . . .	Pain in hands, blurring of vision.
26	. .	. . .	. . . .	. . . .	. . . .	Choking spells.
27	. .	. . .	5.8	. . . .	. . . . .	Choking spell. Convulsion unconscious for a few minutes. 20 c.c. $CaCl_2$ 5 per cent intravenously.
28	60	. . .	5.4	. . . .	. . . . . .	Complains of sore mouth only.
29	60	. . .	. . . .	. . . .	. . . . . .	No complaint.
30	60	. . .	. . . .	. . . .	. . . . . .	No complaint.
31	60	. . .	. . . .	. . . .	. . . . . .	No complaint.
Feb. 1	60	. . .	5.9	. . . .	. . . . . .	No complaint.
2	60	. . .	5.15	. . . .	. . . . . .	Complained of pains in hands, arms and no sleep. 2 gm. $CaCl_2$ intravenously.
3	60	. . .	5.3	. . . .	. . . . . .	Marked pains, codeine grain ½.
4	60	. . .	. . . .	. . . .	. . . . . .	Severe pain, unable to sleep, codeine grains 2½.
5	25	300	. . . .	. . . .	. . . . . .	Pains; .5 gm. $CaCl_2$ intravenously.
6	25	300	. . . .	. . . .	. . . . . .	No complaint. First day of meat-free diet.
7	25	300	6.91	. . . .	. . . . . .	No complaint. Meat-free diet.
8	25	300	. . . .	. . . .	. . . . . .	No complaint. Meat-free diet.
9	25	300	. . . .	. . . .	. . . . . .	No complaint. Meat-free diet.
10	25	300	. . . .	. . . .	. . . . . .	No complaint. Meat-free diet.
11	25	300	7.9	. . . .	. . . . . .	No complaint. Meat-free diet.
12	25	300	. . . .	. . . .	. . . . . .	No complaint. Meat-free diet.
13	25	300	. . . .	. . . .	. . . . . .	No complaint. Meat-free diet.
14	25	300	7.2	. . . .	. . . . . .	No complaint. Meat-free diet.
15	25	300	. . . .	. . . .	. . . . . .	No complaint. Meat-free diet. Patient went home, apparently normal.

remission, so he was sent to the Colorado General Hospital February 10, 1928. Since that time he has been on a meat-free diet with calcium chloride grains 100 and cod-liver oil, three times a day. Chart IIB shows what if any effects the hormone had on his blood calcium and symptoms.

SUMMARY

1. Further surgical prevention of parathyroid tetany seems to depend upon the development of the technique of re-implantation of parathyroid tissue at time of operation, especially in patients operated two or more times.

2. Calcium by mouth is of little value in the absence of adequate parathyroid tissue. It is impractical to give it intravenously in chronic tetany.

3. The feeding of dessicated parathyroid gland seems useless.

4. The subcutaneous administration of the parathyroid hormone in dosages as usually given has little, if any, influence on the blood calcium level. Apparently it should be given in much larger dosages.

5. The clinical symptoms seem to be as good a guide to the amount given as the blood calcium level.

CHART IIB, CASE II
HOME ON MEAT-FREE DIET FOR ABOUT TWO AND ONE-HALF MONTHS

Date	Para-hormone	Calcium Lactate	Blood Chemistry			Clinical Notes
			Cal-cium	Phosphor-ous	Plasma CO_2	
1928 Feb. 18	30	300	7.0	...	..	Doing well.
24	30	300	7.0	...	..	Doing well.
Mar. 5	30	300	7.2	...	..	Doing well.
14	30	300	6.4	...	..	Doing well.
20	30	300	7.0	4.9	63	Doing well.
29	30	300	9.0	...	..	Doing well.
Apr. 3	30	300	8.3	...	..	Doing well.
20	..	300	8.1	...	..	Doing well.
26	..	300	8.6	...	..	Doing well.
27	..	300	...	...	..	Lost appetite. Pain in stomach, complained of head cold. Slight constriction in chest.
29	40	300	4.3	...	..	Definite tetany symptoms. Unable to secure weekly blood calcium, was necessary to give 1 or 2 gm. calcium chloride intravenously daily until he was readmitted to hospital.

CHART IIC, CASE II
REENTERED HOSPITAL MAY 28, 1928

Date	Para-hormone	Calcium Lactate	Blood Chemistry			Clinical Notes
			Cal-cium	Phosphor-ous	Plamsa CO_2	
1928 June 2	60	300	4.7	5.2	......	Very restless. Luminol grains 6. $CaCl_2$ 2 gm.
3	90	300	...	...	......	Luminal grains 4½. Patient very restless.
4	90	300	...	...	......	Luminal grains 4½. $CaCl_2$ 2 gm. Stuporous.
5	110	300	...	...	......	Luminal grains 7½. Very restless.
6	120	300	...	...	......	Luminal grains 6. Very restless.
7	120	300	4.9	...	......	Luminal grains 4½. Slightly improved.
8	120	300	...	...	......	Luminal grains 4½. Codeine grains ½. Not so restless. Pains in arms, severe.
9	120	300	2.5	...	......	Luminal grains 4½. $CaCl_2$ 1 gm. Patient restless and emotional. Severe pain, seems irrational at times.
10	120	300	...	...	......	Luminal grains 6. Says he does not feel well but no definite pain.
11	300	300	5.5	...	......	Luminal grains 4½. $CaCl_2$ 1 gm. Very restless and emotional but became quite normal after $CaCl_2$.
12	50	300	4.0	...	......	Luminal grains 4½. Complains of itching sensation but no pain. Not emotional. Up and about and for the first day since admission seems nearly normal.
13	50	300	...	...	......	Luminal grains 4½. Comfortable.
14	50	300	7.1	...	......	Luminal grains 4½. Comfortable.

AN INTERPRETATION OF THE CLINICAL HISTORIES OF MORE THAN 1000 TOXIC GOITER PATIENTS*

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THE material contained in this paper is drawn from the clinical histories of more than 1000 patients who have been given a diagnosis of toxic goiter. More than 800 have been operated upon and the diagnosis confirmed by pathological section and the clinical cure or improvement of the patient. No patient has complained of all the symptoms mentioned and the symptoms have varied greatly in different individuals, due chiefly to age, duration and severity of disease, and type of goiter, whether exophthalmic or adenomatous, though no effort will be made in this discussion to differentiate between the histories of the two types of toxic goiter. A majority of the patients presented themselves without previous examination for their complaint or had been referred with correct diagnosis already made.

Previous erroneous diagnoses have occurred with sufficient frequency to warrant mention of the diseases for which toxic goiter has been mistaken, and these will be mentioned in the order of frequency in which they occurred. It is fair, I believe, to assume that such diagnoses will be made with less frequency in a community where toxic goiter is infrequently encountered. A number of these patients have consulted from one to ten different doctors. Too often this has served to add a confusion of diagnoses to an already bewildered patient. It therefore seems that a review of the complaints of these people may be of value.

The diseases for which toxic goiter has been mistaken will be mentioned first so that they may be borne in mind in a discussion of the symptoms. No attempt will be made to give a complete historical differentiation between these diseases and toxic goiter.

The diagnosis "nervous breakdown," ambiguous term at best, stands distinctly at the head of the list of mistakes. It occurred perhaps as frequently as all others combined. Next is heart disease; 3rd, influenza; 4th, intestinal flu; 5th, nervous indigestion; 6th, hypertension; 7th, various psychoses, nephritis, tuberculosis, gynecological disturbances, etc. "General rundown condition" has done overtime as a diagnosis. One man had his gall bladder removed for the jaundice of an exophthalmic goiter. Numerous others had had teeth and tonsils removed. A few appendices had been removed in cases with pronounced gastrointestinal symptoms.

Almost without exception the patients have been made worse by any operative procedure. I have seen a number of patients in whom a crisis had been precipitated by the removal of tonsils or the extraction of teeth. The patient with toxic goiter, be it exophthalmic or adenomatous, is poorly equipped to withstand any sort of trauma. I mention this because of a pernicious idea that still prevails regarding the treatment of the goiter patient.

A few years ago a number of articles appeared in medical literature relative to the benefits of tonsillectomy to the goiter patient. These were chiefly concerned with associated goiter of adolescence. Others attempted to hitch up focal infections and exophthalmic goiter. As I have seen it, the unhitching has proved rather sad experience for the toxic goiter patients. If focal infection of a damaging nature be pres-

nt, it should be left until the goiter is re-
moved. The foregoing list of mistaken
diagnoses, it will be noted, includes dis-
ases referable to almost every organ in the
body. But as toxic goiter is essentially a
disturbance of so vital a function as me-
abolism, there is no organ in the body that
may not be affected by a disturbance of
his function.

The symptoms complained of by a given
patient as a rule have been multiple. A
majority have experienced all three clas-
sical symptoms of the disease, namely, ner-
vousness, tachycardia and loss of weight. In
other patients there has been a tendency
for one system or group of organs to
be affected more or less than the others.
In some, nervous symptoms have pre-
dominated; in others, cardiovascular; in
others, gastrointestinal; in others, muscular
symptoms. It is likely that these variations
are more dependent upon individual sus-
ceptibilities or constitutional inherited
tendencies than upon any selective action
of the thyroid secretion for any particular
tissue. In the aggregate, symptoms have
been encountered referable to every tissue
and organ in the body, with the possible
exception of the bones.

HEART SYMPTOMS

The most frequent single complaint is
referable to the heart, yet not infrequently
one encounters a patient with toxic goiter
who gives few or no symptoms referable
to it. The symptom that occurs with the
greatest frequency is tachycardia. Patients
say that the heart beats hard and fast or
pounds. The average patient is more often
conscious of this pounding when lying
down than in the upright position. Few
symptoms occur with more frequency
or are more significant from a diagnostic
standpoint than inability of the patient
to sleep, or at least sleep comfortably, on
the left side. In this position the apex of
the heart rests against the rigid chest wall
and pounding there becomes annoying
and disturbing. In the upright position,
the heart is suspended and the apex does

not strike the chest wall with such force.
When the patient is on the back or the
right side, the semi-elastic pericardial sac
absorbs much of the shock of the apex
beats. In conjunction with the foregoing
it has been an interesting observation that
the pain complained of in the region of
the heart by the goiter patient is more
often at the apex than at the base, such
as occurs in anginal and allied conditions.
Several patients have complained of a
tenderness of the left breast; others of
sensitiveness of the skin in the region of
the apex, due no doubt to the effect of
the pounding ventricles on the intercostal
nerves. In some patients the heart beats
hard and fast continuously. In others the
attacks come on without apparent cause.
In nearly all the cardiac reaction to
exercise and excitement is out of propor-
tion to the degree of effort or the stress
of circumstances.

By questions any history of irregularity
of heart action and edema of the ankles,
should be elicited as these symptoms give
evidence of cardiac damage and decom-
pensation. Furthermore the history of
rapid and irregular heart action becomes a
diagnostic clue of the greatest importance.
Particularly is that true in communities
where goiter is endemic. I once heard
Plummer of Rochester state that 90 per
cent of the cases of auricular fibrillation
that occurred in the Mississippi valley
were due to goiter. In my own experience
the percentage has been greater than 90
per cent. If one can diagnose the cause of
auricular fibrillation in 90 per cent of the
cases, it is a very high average and toxic
goiter should always be considered when
one finds a rapid irregular heart. Occa-
sional extrasystoles are less significant.
Relative to increased pulsations, in extreme
cases the patients may feel a pulsation
throughout the entire body, but the
majority of them will only have noticed
it in the neck and the epigastric region, due
respectively to increased pulsations in the
carotids and the abdominal aorta. The
range of disturbed cardiac activity is

extremely wide and varies from the violent heart beats that shake the bed on which the patient lies or are audible for a few feet down to slight attacks of palpitation or shortness of breath on exertion.

GASTROINTESTINAL SYMPTOMS

A surprising number of patients have centered their complaints on some gastrointestinal disturbance. The story generally runs something like this: "A few months ago I began to get nervous and shaky and lost my appetite. I was nauseated for a few days or a few weeks at most. Any kind of food caused distress: a sensation of fulness in the upper abdomen. This passed off and then I had an abnormal appetite, could eat anything without distress, was always hungry, but continued going down and losing weight and strength. About the same time, I noticed my heart beating hard and fast. I was warm all the time and perspired freely." Others have had a painless and unexplainable diarrhea; some have vomiting and this, unless of short duration, becomes a very serious phase of the disease. There is no other disease that gives the foregoing history. A diagnosis can be established with practical certainty on such a history.

I have seen a number of patients whose chief complaint was nausea and vomiting accompanied by a very distressing pulsation in the epigastrium. Several such had been previously given a diagnosis of aneurysm of the abdominal aorta. I know of no disease except exophthalmic goiter that causes nausea and vomiting accompanied by pronounced pulsation in the epigastrium. Without exception, these symptoms have been relieved by the removal of the goiter.

It is difficult on a physiological basis to explain the symptoms of nausea vomiting, and diarrhea, unless they are of a toxic nature. It is in this group of patients that the erroneous gastrointestinal diagnoses have occurred. I always suspect toxic goiter in any adult who gives a history of having had "intestinal flu" or painless diarrhea. Gastrointestinal disturbances in toxic adenoma are not frequent, but occur occasionally in the more active phases of the disease.

NERVOUS MANIFESTATIONS

The nervous symptoms have been many and varied, the more frequent having been described as a "feeling of nervousness." The patients are restless, impatient, irritable and cranky. They lose the power of concentration and continued effort. Small annoyances disturb them out of proportion to their importance. Increased excitability is a most constant symptom, accompanied by an increased physical response to excitement and emotional disturbances. They often say they become so weak and shaky from excitement or from being startled that they are almost helpless. The ringing of the telephone or door bell may upset them markedly. Emotional disturbances are frequent. They cry or get angry about nothing at all. They are difficult to manage both at home and abroad. In contradistinction to the neurasthenic, the goiter patient is a hopeful or optimistic individual. He believes in himself and his ultimate recovery. He may and often does have periods of depression. He may lose interest in his work but not in himself.

Of all the nervous symptoms the one that most concerns the patient is tremor. To her it is frequently the most conspicuous symptom. However, it is not purely a nervous but a neuromuscular symptom. She notices it when writing, eating, threading a needle, etc. She spills coffee or tea over herself or her friends, drops dishes and does various other embarrassing things. Women often go so far as to avoid social functions, teas, etc., for this reason, and because they do not wish other women to think they are easily fussed or confused. In addition to the tremor of the hands and knees they often describe a trembling, shaky feeling inside them. They cannot locate it, but when they have this feeling they usually also have an exophthalmic goiter.

MENTAL SYMPTOMS

A true psychosis has been encountered only once in this group of cases. The patient had been confined in an insane asylum for violent outbursts of temper and because she sat out in the rain clothed only in her nightgown. These outbursts could be explained by the presence of an exophthalmic goiter. It is also possible that she sought relief from an excessive heat production by recourse to the only available shower, as at the time of the onset of her illness she resided in the country, where bath tubs and showers were non-existent. It is now more than two years since she was operated upon and while at present she is no mental giant, her condition is in no way different from her previous normal mental and physical state.

Several cases of delirium and coma were encountered. These are as a rule of short duration, chiefly because patients die in this condition, unless it is checked in a short time. However, one patient was delirious intermittently for nearly three months.

NERVOUS BREAKDOWNS

It has been an interesting observation that from 20 to 30 per cent of all toxic goiter patients give a history of one or more nervous breakdowns, also that fully 90 per cent of those who have given such histories on careful analysis, have been found to describe clinical symptoms strikingly parallel to exophthalmic goiter, and should have been so diagnosed. Nervous breakdown is a dangerous diagnosis and will lower your batting average if you stick to it. The history of a nervous breakdown is a most important clue and generally narrows a diagnosis down to one of two groups of condition, namely, the neurasthenic group, including the nervous exhaustion and neurocirculatory asthenic types and the toxic goiter states. If one will think of a nervous breakdown as in the majority of instances signifying one of the two conditions, it will help to clarify many diagnoses. It might be said that a basal metabolic determination is the Wassermann test of the nervous breakdown. A few well chosen questions should, however, result in establishing the differentiation between neurasthenic and toxic goiter syndromes.

HEAT DISTURBANCES

It is not possible to have an increase in basal metabolism without having an increase in heat production. The patients whose metabolic rates reach the higher levels are naturally the ones who complain most of a sensation of warmth. They wear fewer clothes, sleep under lighter covers and avoid warm rooms and close places. They require more fresh air than the normal person, as their need of oxygen is greater. Hot weather is very depressing to them.

Most of the symptoms of toxic goiter can be explained on the basis of altered physiology. Considerable is known of the pathological physiology of exophthalmic goiter. When considering the diagnosis of exophthalmic goiter, if the given symptoms do not coincide with the known physiological changes, it is safe to assume that one is dealing with another condition. It is in connection with this increased heat production in toxic goiter cases that I have observed one of the distinguishing differential diagnostic features between the toxic goiter patient and the neurasthenic. The former is warm and has warm hands, often flushed, with well distended veins. The neurasthenic is often cold or has chronically cold hands, the pale, veinless type. I know of no single differential diagnostic feature that is more significant than this. I have made it a rule to shake hands with every new patient that comes into the office. It has given me much valuable information relative to the line of questioning.

SWEATING

The human body, like the engine in an automobile, rids itself of excess heat by surface radiation and evaporation of mois-

ture. The sweating that these people complain of is nature's means of maintaining the body temperature at 98.6°F. in the face of increased heat production. Sweating is abnormally increased by both exercise and excitement.

MUSCULAR SYMPTOMS

Mention has already been made of tremor which is a neuromuscular symptom. Weakness is present in varying degrees, usually dependent upon the severity of the disease. In some cases it is the outstanding feature. As pointed out by Plummer, weakness of the quadriceps muscle is a characteristic symptom of exophthalmic goiter. It is brought to the patient's attention more noticeably in climbing or going down stairs, or in stepping up into a street car. Often the patient has to pull herself up. There is also an abnormal softness of the muscles. Pathologically, there is fatty degeneration of the muscle fibers. This accounts for the frequent early dilation of the heart in these patients, whose muscles have become soft and flabby.

DISTURBANCES OF SLEEP

Many complain of insomnia. They are restless in bed and complain of bad dreams and nightmares, a fertile field for the psychoanalyst.

SKIN CHANGES

Flushing of the skin is frequent in exophthalmic goiter, less so in adenoma. It is a vasomotor response and has a double protective function. It is due to surface capillary dilation and serves to lessen the intraarterial tension of an accelerated circulation, also to bring a larger volume of blood to the surface for heat radiation. Itching of the skin and a diffuse rash are occasionally encountered in the more active types of exophthalmic goiter, probably toxic in origin.

Increased pigmentation occurs in both diseases, but is seldom complained of by the patient. It is likely to be diffuse in exophthalmic goiter and localized around the neck in adenoma.

CHANGES IN THE VOICE

Changes in the voice develop from one of three causes. In those patients not operated upon they occur in my experience most frequently in exophthalmic goiter. The voice in these cases is weaker and slightly more coarse. The patients state that it is weak and that they have a tickling sensation in the throat. They are constantly clearing the throat on account of excess mucus. I have seen no paralysis of a vocal cord in an unoperated exophthalmic goiter. The voice changes have occurred in patients with very hard glands also very active glands, as the two are frequently associated. The voice changes in these cases are largely due to congestive disturbances of the mucosa of the trachea and larynx. They disappear when the goiter is removed.

Next in frequency of voice changes are those due to paralysis of one recurrent nerve. Just about 50 per cent of the patients who have consulted me for recurrence following operations have given a history of temporary loss of the voice for periods ranging from two to eight months thereafter. Almost invariably these cases have had a partial or complete paralysis of one vocal cord. Often one can get a clue to vocal cord paralysis by asking the patient to say "e-eee" in a high pitched voice. Frequently they cannot do it.

A majority of recurrences have been unilateral and have occurred on the same side as the functioning vocal cord, a most important point when considering further operative treatment. Vocal cord paralyses have occurred in untreated cases but in only 1 has a complete cord paralysis existed. Voice changes due to tracheal pressure and narrowing of the trachea have occurred in a considerable number of the larger adenomas and in a fairly high percentage of substernal and intrathoracic goiters.

CHOKING OR PRESSURE SENSATIONS

Choking and pressure sensations have been complained of in about 10 to 20 per cent of the cases. They, too, have occurred in a much greater relative percentage of substernal goiters. In cervical goiters, choking and pressure have had little or no constant relation to the size of the goiter. These symptoms have been present in simple colloid goiter about as frequently as in toxic goiter.

DYSPHAGIA

Difficult swallowing has been complained of in all types of goiter, but not very frequently is it the chief complaint. When it has occurred as such, the causative lesion has as a rule been in the esophagus and of the nature of a stricture, cardiospasm or malignancy. Fluoroscopic examination with barium meal should be made in all cases with such a history.

DYSPNEA

Two classes of difficult breathing have occurred. One, a shortness of breath on exertion, is of cardiac origin. It may mean cardiac damage or an overworked heart. The other, a pressure dyspnea, is encountered in adenomas and malignancies and is due to narrowing of the lumen of the trachea. The sounds made by these patients on coughing and deep inspiration are pathognomonic.

MUCUS IN THE THROAT

In the literature I have seen no mention of an increase of mucous as a symptom of toxic goiter, but a large percentage of patients have it. The usual history is that it began simultaneously with the onset of other symptoms.

HEADACHE

Headache has occurred in about 50 per cent of the cases. It has been characteristic in type, that is, it is usually occipital and associated with an aching pain in the back of the neck. Historically the goiter headaches are rather distinct, in that patients give a definite or approximate date of onset. Others who had previously suffered from headaches name a date on which they became worse, and since which they have been more frequent and more severe. The relief of headache following removal of the goiter has been striking, it being the only pain complained of.

EYE SYMPTOMS

One might think that the displacements of the eyeball, the disturbances of the ocular muscles and the abnormal relationship of the eye to the lids would constitute one of the very disturbing phases of the disease, but such has not been the case. A surprising degree of exophthalmos often exists without the patient being aware of it. The symptoms complained of are, as a rule, a burning and irritating feeling in the eyes and an early fatigue from reading. Quite a number have commented on a sensation as if something were pushing the eyeball outward. A few of the more advanced cases have developed squints and double vision, due to disproportionate weakness of the ocular muscles.

THE GOITER

As stated earlier, few symptoms are referable to the neck. A relatively small percentage of the patients have noted the simultaneous appearance of their symptoms with the appearance of a goiter. Those who have made such an observation have, as a rule, had exophthalmic goiters. A relatively large percentage of exophthalmic goiter patients have noted indefinite changes in the gland, among which are increases in size and hardness of the goiter and increased pressure. The changes in adenomas associated with changes in function on the whole have attracted less attention. They have existed for years as a rule, the patients having become accustomed to them. The local changes in circulation, vascularity, etc., do not occur so quickly nor so extensively as in exophthalmic goiter and are, therefore, less noticeable. If

an adenomatous goiter suddenly begins to grow in a person past thirty-five years of age, and continues, it usually means the beginning of hyperfunction.

GYNECOLOGICAL DISTURBANCE

So far as I have been able to determine, there has been no rhyme nor reason in the responses of the female reproductive functions to the effects of toxic goiter. The following gynecological symptoms have been repeatedly encountered. Amenorrhea: One woman, aged twenty-two, did not menstruate for fifteen months. This symptom developed shortly after an unusually severe exophthalmic goiter. Several had amenorrhea for periods varying from three to eight months. Others have had menorrhagia and metrorrhagia. In some all symptoms have been exaggerated at menstruation; in others they have been unaffected. The tendency for toxic goiter to develop at or about the menopause is well known.

CONCLUSION

No one symptom is infallible as a diagnostic criterion. One must get a mental picture of the altered physiological responses to the presence of toxic goiter, and with a knowledge of the possible resultant symptoms, one can in any given case of toxic goiter build up a picture that will fairly accurately fit the disease.

TRAUMATIC OPHTHALMOLOGY
CONTUSION OF THE EYELIDS AND CONCUSSION OF THE EYEBALL*

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SINCE surgeons and physicians who have had little training in ophthalmology are frequently confronted with patients complaining of various symptoms because of an injury to the eye from a blunt object, it may be of interest and real value to consider what may occur when the eyeball is struck, and what the treatment of the various conditions should be.

CONTUSION OF THE EYELIDS

Most medical men are familiar with the marked swelling of the eyelids which may result from the slightest injury. This swelling is due to the fact that, in order to facilitate the motion of the eyelid, the skin is very loosely attached to the underlying tissues. The familiar "black eye" is attributable to the extravasated blood from which the hemoglobin has been set free. In the early stages, until the swelling begins to subside, the condition is best treated by cold compresses of a saturated solution of boric acid. In severe cases an ice cap may be used or a small piece of ice wrapped in cloth may be applied. In some instances, even without fracture, the eyelid of the other eye may show discoloration. If the nasal wall of the orbit is fractured, an attempt to blow the nose may force the air into the surrounding tissues. This condition is easily diagnosed by the crepitation noted when the eyelid is palpated. In this type of injury, a pressure bandage should be applied and the patient should refrain from blowing the nose. Further treatment consists in keeping the nasal passages clean and applying cold compresses to the eyelids.

INJURIES OF THE EYEBALL

Rupture of the eyeball is often caused by a blunt object forcing the eyeball against the bony orbit. Usually the rupture takes place in the angle of the anterior chamber and frequently involves the canal of Schlemm which is concerned with the filtration of the fluids within the eyeball. This canal is in the thin part of the external coat, and is unprotected externally by muscles or other binding tissues. The conjunctiva is so elastic that the lens of the eye may be forced out under it without rupture and appear as a swelling beneath the conjunctiva. If this occurs and the patient is seen early the lens should be removed. Prolapse of part or all of the iris may take place, which would demand surgical intervention. It is usually necessary to excise the prolapsed iris, thereafter inserting a superficial mattress suture in the cornea and episcleral tissue. The conjunctival wound is closed separately. If the vitreous also tends to prolapse, it should be cut away and the lips of the wound brought together by one or two mattress sutures. It is remarkable how much vitreous may be lost with the retention of useful vision. Although many of these eyeballs go on to atrophy or secondary infection, useful vision is retained in some, and consequently, enucleation should not be too hastily performed. To prevent infection the patient should be given an injection of tetanus antitoxin or some nonspecific protein to increase non-specific resistance to infection.

If the blow directed against the eyeball is not sufficiently severe to produce rupture

This is the first of a series of articles on Traumatic Ophthalmology. The next will appear in an early issue.]
Submitted for publication, Sept. 7, 1928.

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of the sclera, many other injuries, commonly not suspected by any except ophthalmologists, may result. *Hemorrhage* frequently follows contusion, subconjunctival hemorrhage being the most usual. This appears as a reddish black discoloration of the conjunctiva which tends to gravitate below the cornea. In the early stages this condition calls for cold compresses; in the later stages hot compresses are used to hasten absorption of the blood.

Hemorrhage may also occur into the anterior chamber, filling it with blood, and sometimes blood may find its way into the cornea, producing a typical picture caused by absorption of coloring matter from the blood. The presence of blood in the anterior chamber frequently leads to increased intraocular tension or secondary glaucoma. This condition sometimes requires a paracentesis of the anterior chamber in order to reduce the tension.

A hemorrhage into the vitreous may take place, or a subhyaloid hemorrhage, that is, between the retina and vitreous, may occur. This type of hemorrhage changes position as the patient moves his head. Hemorrhages into the retina usually appear flame-shaped when superficial or more rounded when deeper; they may be subretinal causing detachment of the retina, or subchorioidal with a resulting detachment of the chorioid. Subchorioidal hemorrhages appear as dark, rounded masses extending into the vitreous, and usually offer a good prognosis. Treatment of these hemorrhages usually consists of rest of both eyes, use of atropine in the affected eye, application of ice or iced compresses in the early stages, and hot compresses in the later stages. Following this, a weak solution of dionine may be used, beginning with 1/4 of 1 per cent in the affected eye at night and gradually increasing until a 10 per cent solution is used.

CORNEA

The cornea is often slightly abraded by contusion but is rarely ruptured unless previous disease or injury has thinned it.

To detect abrasion of the cornea a 3 per cent dilution of fluorescein is instilled into the eye; after irrigation the abraded area remains deeply stained. This condition is usually accompanied by great discomfort and sometimes by severe pain, which is best controlled by the use of a 2 per cent holocaine solution instilled into the eye. Bichloride of mercury ointment, 1:5000, is introduced between the eyelids, and a dressing is worn until the area no longer stains. Owing to the possibility of infection of the denuded area the use of a dressing is most important.

If a corneal rupture with prolapse of the iris has occurred, the iris should be excised, atropine instilled, and bichloride of mercury ointment, 1:5000, placed between the eyelids. No stitches are used unless there is a large wound the edges of which do not approximate properly, when a superficial suture may be inserted in the cornea with a fine curved needle and No. 1 or finer paraffined silk. The conjunctiva may be dissected up from the limbus and brought down over the wound where it is held by mattress sutures on each side of the cornea, which engage the conjunctival flap and conjunctiva below the cornea.

Milder injuries may give rise to a low-grade traumatic inflammation of the cornea, called traumatic keratitis, in which the stroma of the cornea may be filled with leucocytes. Rupture of Descemet's membrane, recognized as gray streaks under higher magnification, may also occur.

IRIS

The iris frequently shows one or two notches at the pupillary margin due to a partial or complete rupture of its sphincter. This is due to the backward displacement of the iris, and the rapid dilatation which occurs from the injury. If seen early the pupil may be widely dilated but after the inflammatory signs have subsided the use of a 1/2 per cent solution of pilocarpine and massage of the eyeball will tend to restore it to normal. However, there may

remain a slight notching of the pupillary margin. This is seen best under high magnification. Dilatation of the pupil may occur without injury to the sphincter, due to the rapid stretching of the muscle which produces temporary paralysis, or to injury of the third nerve fibers in the region of the ciliary body. The same treatment as for rupture of the sphincter is of benefit in some cases. The iris may be torn away from its attachment to the ciliary body. This is called iridodialysis, and may be only a small tear, or the iris may be completely separated from its attachment. Little can be done for this injury except to use atropine. If the iris is torn away sufficiently to obstruct the light entering the pupil or if it permits the passage of light through the normal and through the traumatic pupil, a monocular diplopia may be induced, sometimes making it necessary to perform an iridectomy of the prolapsed portion. Iris tissue does not usually tend to reunite, but fortunately this injury most often occurs at the periphery of the iris and causes little or no discomfort. The condition is frequently accompanied by hemorrhage into the anterior chamber.

CILIARY BODY

The iris and part of the ciliary body may become detached by a rupture through the pectinate ligament at the angle of the anterior chamber. This may cause a deepening of the anterior chamber and usually results in some weakening of accommodation. After the early use of cold compresses, atropine and rest, hot compresses and exercises in reading fine print at different distances may help to reestablish accommodation. If the lesion affects the ciliary body, which, according to many authorities, influences the secretion of the intraocular fluids, the secretion may be diminished with a resultant lowering of the intraocular tension. Weakness of accommodation may also result from injury to the ciliary body without apparent rupture of the tissues and for this injury

accommodative exercises may be of value in the later stages. For the persistence of lowered tension in the eyeball, hot compresses are usually beneficial and in addition the use of increasing strengths of dionine solution. Subconjunctival injections of 5 to 10 minims of normal or hypertonic salt solution once or twice a week after anesthetization of the conjunctiva with 3 drops of 2 per cent holocaine and 2 minims of adrenaline, 1:1000, might be of benefit in raising the tension.

LENS

The most common injury is a dislocation of the lens. This is due to a partial rupture of its suspensory ligament which causes tilting of one edge of the lens resulting in a shallow anterior chamber in this area. Iridodonesis (trembling of the iris when the eye is moved) may result and is due to the fact that the pupillary margin of the iris lacks the support of the lens. If the angle of the anterior chamber is sufficiently blocked by the vitreous and by the iris which is pressed forward, intraocular tension may be increased. In severe injuries the iris may be caught behind one edge of the lens; this is known as retroflexion of the iris. Dislocation of the lens into the anterior chamber where it is held by the iris may also follow a severe injury. This usually requires removal of the lens, owing to the fact that circulation of the intraocular fluids cannot be maintained, resulting in secondary glaucoma. The lens may also be forced backward into the vitreous chamber where it may be held by the partially ruptured fibers of the zonule of Zinn or may float free in the vitreous and be seen as a white mass when the head is bent forward, when it usually appears in the pupillary area. In some instances the lens may be brought into the anterior chamber by having the patient hold his head down and forward. Eserine is instilled while the patient is in this position. Later the lens may be transfixed with a needle and removed. Dislocation of the lens into the posterior chamber is the oldest operation

for the treatment of cataract and is called "couching." In some cases no marked impairment or apparent disturbance of vision occurs. However, since glaucoma seems more likely to affect this eye than the normal eye, the lens should be removed if it can easily be done.

Cataract frequently results from these injuries because of a partial rupture of the capsule of the lens which permits the entrance of the aqueous with power to dissolve lens fibers. This may result in complete dissolution of the lens, or the lens may become partially opaque in some areas. If the opacity involves the pupillary area it is usually advisable to extract the lens in older patients, and needle it in patients under twenty-five or thirty years of age.

THE CHORIOID

The chorioid frequently becomes ruptured owing to stretching of the eyeball, as the chorioid is firmly attached anteriorly and there is a firm attachment posteriorly around the optic nerve. The rupture frequently appears as a crescentic lesion between the optic nerve and the macula. In the early stages rest and atropine provide the only measures of relief for this type of injury. But owing to the fact that a hemorrhage usually occurs from injury of the chorioidal vessels, rupture is, as a rule, not diagnosed until later.

When the hemorrhage occurs beneath the chorioid, the chorioid and retina may bulge forward and the lesion appear as a brownish red tumor covered by retinal blood vessels protruding into the vitreous. Chorioidal detachment by hemorrhage offers a better prognosis than retinal detachment, in that absorption of the hemorrhage usually occurs, leaving very little if any disturbance of eye function.

THE RETINA

The retina as well as the chorioid may be ruptured, but because the former is more elastic, it ruptures less frequently than the chorioid. Traumatic detachment of the retina is extremely common; it should be treated by rest and cold applications in the early stages, with the head elevated if the detachment is below, and with the head on a level if the detachment is above. Subconjunctival injections of normal or hypertonic salt solution are of value in this condition. If reattachment does not take place, trephine of the sclera and sucking out of the subretinal fluids may be attempted. Unless there has been a tear in the retina, good results are sometimes obtained. We do not hesitate to operate several times, even though the detachment reoccurs. One should also consider the treatment of complicating focal infections, particularly those affecting the nose and nasal sinuses, as we feel that these conditions may influence the outcome in a case of traumatic detachment.

A grayish white opacity of the retina, known as commotio retinae, is frequently noted as a result of injury. This gray opacity occurs in the region of the macula which appears dark red in comparison with the surrounding edematous retina. Although the vision may be markedly affected at first, it usually improves rapidly. Sometimes atrophy of the rods and cones results; the pigment epithelium may proliferate into the retina and appear as brownish yellow patches scattered around the injured area. In some cases, there is a shallow hole in the region of the macula, the macula appearing deep red with a gray, slightly elevated edge of the retina surrounding it. Since this is probably due to edema and degeneration of the nerve element surrounding the macula, it is usually observed some time after an injury.

OPTIC NERVE

A light blow on the eyeball may set up a low-grade traumatic inflammation of the nerve giving rise to congestion of the nerve head with possible blurring of the margins. In these cases field studies usually show a slight enlargement of the blind spot, and in some cases when the intraocular portion of

the optic nerve is not involved, there may be a retrobulbar traumatic neuritis and enlargement of the blind spot may be the only sign which can be noted. Two of our patients injured by squash balls showed this type of lesion with a slight diminution of visual acuity. If the injury is sufficiently severe, the nerve fibers may be torn away, resulting in evulsion of the optic nerve. The nerve fibers are less elastic than the sheath, which possibly accounts for this anomaly.

TRAUMATIC ENOPHTHALMOS

Traumatic enophthalmos occasionally follows contusion of the eyeball and orbit. Sometimes it occurs immediately after the injury but usually several weeks elapse before it becomes apparent. The condition most frequently encountered is a cicatricial contraction of the orbital tissue or an indirect fracture of the rim of the orbit with depression of the fragment of the bone outward so that the volume of the orbit is enlarged. Several cases have been reported in which no fracture of the orbit could be demonstrated, and Oast,[1] examining a patient one hour after injury, found the eyeball definitely sunken into the orbit about ¾ in. Examination under general anesthesia revealed complete divulsion of the oblique check ligaments of the recti. There were no well-defined adhesions except at the margin of the optic foramen. These were considered a possible cause of the enophthalmos, another possibility being that the nerve might have become incarcerated in the optic foramen. Bard[2] believes that enophthalmos associated with miosis, following diplopia and amblyopia after traumatism, is the result of injury to the orbital nerves and not to the trunk of the sympathetic.

Treatment naturally depends upon the exact anatomical cause of the enophthalmos. To lessen the enophthalmos Seefelder[3] tenotomized the four recti which did not produce diplopia and left a fairly movable eyeball. A roentgenogram of the region should be made in order to determine whether or not the orbit has been fractured.

SYMPATHETIC OPHTHALMIA

Sympathetic ophthalmia has been reported following concussions and injuries of the eyeball. Uveal pigment has been used in the diagnosis of this condition but the complement-fixation test for uveal pigment described by Woods[4] in 1917 and modified in 1921[5] has been discarded by him as impractical except for research work, and the intracutaneous test for pigment hypersensitivity substituted. The normal suspension, as originally suggested by Woods,[4] was made for us[6] and eighteen tests have been made with negative results, which should be expected if Woods' findings are correct, as no case presented signs of sympathetic inflammation. Woods and Knapp[7] were the first to treat sympathetic ophthalmia by desensitizing injections of uveal pigment in patients showing increased intradermal sensitivity. They treated 5 patients with desensitizing injections, and their results were encouraging, but as yet they do not wish to draw conclusions. We have had no experience with desensitizing injections.

If sympathetic inflammation is due to an infection, as some believe, nonspecific protein therapy may prove as beneficial as uveal-pigment injections, and Verhoeff[8] has apparently had good results with nonspecific treatment.

SECONDARY GLAUCOMA

Secondary glaucoma may immediately follow an injury or may be delayed for months or years. Any trauma which disturbs the anatomical relationship so as to cause a shallow anterior chamber, or to obstruct the angle with a resultant blocking of the excretory channels, tends to produce glaucoma. An intraocular hemorrhage, especially if subchorioidal, frequently causes the retina and chorioid to be pushed forward in front of the effusion of blood, closing the angle of the anterior chamber by pressure from behind and causing a rapid rise of the intraocular pressure as a result of the sudden increase of ocular contents.

Many other types of injury tend to bring about an increase in intraocular tension. Among these are rupture of the cornea with entanglement of the iris, producing an obstruction of the filtrating angle. Dislocation of the lens in such a manner as to cause interference with the outflow of aqueous current may induce secondary glaucoma.

Iridocyclitis, which frequently follows an injury, may precipitate an acute attack of glaucoma at any time. Acute glaucoma, coming on soon after an injury, is more easily recognized as the condition is usually accompanied by intense congestion, pain, loss of vision, and haziness of the cornea.

However, we must not lose sight of that type of glaucoma which comes on insidiously after many weeks or months, unaccompanied by pain or discomfort, but causing a steady loss of vision. The treatment must first be symptomatic; the tension must be lowered or vision will be lost. But above all else we must correct the cause, if possible.

CONCLUSIONS

From our experience in treating injuries of the eye it would appear that eyes are sometimes too hastily removed. Useful vision may often be preserved in eyes which at first appear to be totally destroyed.

Contusion injuries of the eyeball and eyelids in the early stages are usually benefited by cold, in the later stages by heat.

Because of the possibility of infection of the denuded area after abrasion of the cornea, a dressing is most important until the abrasion has healed.

Many injuries of the eye must be and can be well cared for by the general physician or surgeon who will find the ophthalmoscope and some knowledge of the normal tension of the eyeball important aids in diagnosis.

Secondary unrecognized glaucoma may rob the patient of useful vision which should be preserved. If glaucoma results, an ophthalmologist should be immediately consulted, as this condition is one of the most difficult of all ocular diseases to treat successfully.

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THE IMPORTANCE OF EARLY TREATMENT OF
RECENT FRACTURES OF THE NOSE*

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THE object of this communication is not to advocate the early application of such treatment as has, to a large extent, been given broken noses in the past, but rather to caution against the measures that have been commonly employed, for they have often been the direct cause of disfunction and have frequently been responsible for deformities that might have been avoided, or at least have been less severe, had no treatment whatever been given at the time of the injury.

For some reason injuries to the nose have not received the attention that their importance deserves. This may be due to the fact that the injury to the nose of itself, seldom threatens the life of the patient, consequently both he and the doctor are content as soon as the hemorrhage has stopped and a piece of adhesive plaster has been tightly stretched across the bridge of the nose. The latter is about the worst thing that could be done to a nose that has been macerated by a blow. Strange to say this is the treatment usually received, as elicited from the patients coming to me for the correction of old traumatic deformities, many of whom are also suffering from pronounced nasal obstruction.

Unfortunately the resiliency of the cartilage and the swelling of the soft tissues often mask at the time of the injury the real damage that has been done to the supporting framework of the nose; it is this that determines the complications that so frequently follow. It is the duty of the one who first sees the patient after the injury to take steps to avoid these disagreeable sequelae. He should bear in mind that the immediate results are of far less importance than those that will follow later if the case is not properly treated.

Inspection, on account of the swelling, may reveal nothing of value, and one may be deceived by palpation, as the crepitus of both blood and emphysema closely resemble that of fracture.

In children roentgen-ray examinations are usually unsatisfactory. In adults not only must a soft tube be used but the position of the head in making the plate must be just right in order that a correct estimate of the lines of fracture can be made and the displacement of the fragments can be correctly judged. Roentgen-ray examinations of injuries to the nose give one an idea of their extent but it is difficult to estimate the exact displacement of the fragments by this means because the position of the head varies and, furthermore, the delicate shadows cast by the parts involved leave on the plate only an indistinct and incomplete record of what has happened. In some cases it is remarkable, as shown by the roentgen-ray plate, the distance fragments of the nasal bones will be displaced from their original position by a severe blow upon the nose. Because the fragments are not acted upon by muscular traction, as is the case in fractures of the long bones, it is not easy to explain the phenomenon. This inability to follow up the lines of force which produced the displacement adds to the difficulty of replacing these fragments in their proper position for, the direction of the force being unknown, it is not possible to correct the deformity by reversing it.

The importance of apparently trivial injuries to a child's nose is frequently not realized until years later when a badly

deflected septum and a distorted or flattened nasal bridge can be traced back to an injury which at the time received
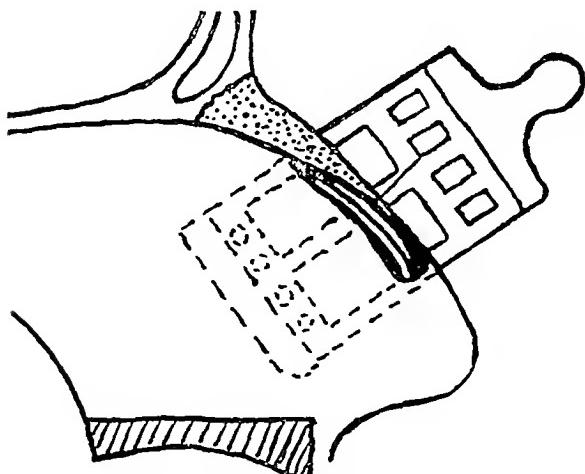
Fig. 1. Sectional view of bridge splint in position.

inadequate or no treatment at all. The frequency of this catastrophe, as noted among the histories of the patients who come to me for correction, prompts me to say that all traumatic injuries to the nose before the organ is fully developed should receive careful consideration at the time and be given treatment intended to forestall the complications that so frequently follow later in life.

The diagnosis of fracture, as I have already said, is not always easy, especially in children. Therefore after utilizing all of the aids to diagnosis already mentioned, including roentgenography, if we are still in doubt as to whether or not there is a fracture but are inclined to believe that there is on account of the distortion of the organ, the patient should be given the benefit of the doubt and proper treatment for fracture instituted.

This view of the situation may seem ultra-conservative to those who are not interested in this special field and who are not having brought to their attention almost daily cases that bear indisputable evidence of neglect or maltreatment of injuries to the nose in early life. This situation prevails with all of us as regards conditions outside our own field of effort.

We should realize this weakness that ever threatens specialization and try to keep ourselves in touch with the other fellow's work, at least to a degree that will enable us to make a reasonable diagnosis and offer advice as to whom he should consult for the relief of his particular ailment. It is unnecessary for me to say that a man who has first practiced general medicine and surgery before taking up a specialty is far better equipped not only for successfully practicing in his own specialty, but for recognizing the relationship between his own work and that of specialists in other fields. The judgment of a man who goes into a specialty immediately after leaving college is always warped, even though he may become eminent in his own field. Many of his mistakes and clinical failures, however, may be attributed to his unfamiliarity with conditions that fall within the ken of the general practitioner or specialists in other fields to whom he might refer them with advantage to the patient and credit to himself.

The point the writer wishes to make is that traumatic injuries to the nose should receive early attention from one skilled in diagnosing the extent of the injury and one who is accustomed to treating such cases with a view to preventing future trouble.

The treatment of recent fractures of the nose depends chiefly upon the age of the patient, the extent of the injury and the time that has elapsed since the injury was received. Very seldom does it happen that the case is seen immediately after injury and before there is time for swelling to occur. If the swelling is great, no attempt should be made to set the fracture or to place the dislocated parts in their proper position; this cannot be done accurately at this time, for the extravasated blood and general swelling cause wide separation of the segments of the arch.

The nasal cavities should first be cleansed with Dobell's solution, and the outside cuts and abrasions painted with tincture of iodine, followed by alcohol. Alternate cold and hot compresses or my

nasal water jacket should then be applied until the swelling subsides. On account of the very great rapidity with which healing

manipulated and a slight lifting pressure towards the dorsum of the nose is exerted.

After adjusting the parts, the writer

FIG. 2.

FIG. 3.

FIG. 2. Fractured nose with upward displacement of both nasal bones.
FIG. 3. Compound comminuted fracture of nasal bones.

occurs in this locality, the parts should be adjusted as soon as possible. Healing, following an injury, occurs more quickly in the nose than in any other part of the body; we may expect fairly firm bony union in twenty days. Roentgen-ray examination, too, should be delayed until swelling has subsided. In the case of adults, roentgenography may be of some value in determining the extent of the injury and location of the segments, if fracture or dislocation has occurred.

The management of the case depends mainly upon the extent of the injury and the age of the patient. The use of the bridge-splint in the young is, for obvious reasons, impracticable. Here we must, by the sense of touch and by the use of a small size moulding forceps, such as my own, endeavor to replace the fragments in their proper position. One blade of the forceps is introduced into the nasal cavity and the other, padded with rubber tubing, rests on the outside of the nose. The septum is lined up by placing a blade on either side and simultaneously the fragments are

ntroduces into each nasal cavity a gold wire splint which he has perfected. This is

FIG. 4. Fracture of bone transplant two years after operation. (This case was treated with the bridge splint. The broken ends of the transplant became firmly reunited, with entirely satisfactory result.)

made at the time to suit the case. These are usually left in for forty-eight hours.

In some of these cases in which there is a tendency of the fragments to protrude or override, it is necessary to apply tin-

FIG. 5. Fracture of tip of nasal bones.

after the apex of the nasal arch has been lifted to its normal elevation. The writer has elsewhere described in detail the appli-

FIG. 6.   FIG. 7.

FIG. 6. Old compound fracture of nasal bones.
FIG. 7. Case of Figure 6 after correction by subcutaneous transposition of tissue by intranasal route and bone transplantation.

lined copper splints also perfected by the writer, to the outer side of the nose.

In treating children we must keep constantly in mind the fact that the nose has not yet reached adult proportions and that its normal development depends upon the accurate adjustment of the fractured and dislocated segments of the nasal arch and the lining up and retention of the septum in a vertical position. This is of paramount importance, *for the normal elevation of the nasal bridge depends upon the growth of the septum.*

In fractures of the nose in adults the developmental factor may be ignored. Here we consider the nasal arch more from a mechanical point of view. For this reason we may find most useful the bridge splint which the writer devised in 1908 and which, in selected cases, is used with great satisfaction. It is intended to duplicate the forces employed by nature in the development of the nose. It consists essentially of a hinged, adjustable bridge which fits over the nose and two intranasal splints attached to sutures which pass through the dorsum of the nose and are tied together over the hinge of the bridge

cation and use of this instrument, which, when properly applied before faulty bony union has occurred, will pull the macerated, displaced segments of the nasal arch back into their proper position and hold them there until union has occurred. It is well not to have the traction on the sutures attached to the intranasal splints any greater than is necessary to raise the depressed fragments into proper position. One must also take the precaution to pad well the edges of the wings and to loosen up these each day by means of the adjustment screw and bathe the skin upon which these rest with 95 per cent alcohol. The bridge of the nose where the sutures emerge should also be bathed with alcohol frequently and the nasal cavities should be cleansed with Dobell's solution.

Fractures of the nasal bones probably always communicate with the nasal cavities through lacerations of the mucous membrane, and frequently the fracture is compound through the skin. In the latter the fragments may be more accurately adjusted through the open wound. The writer has, on several occasions, been obliged to enlarge the wound in order to accomplish this, and at times has found it necessary to suture the fragments in place

with chromic catgut. These open wound cases are not suitable for the bridge splint. In these compound cases not only should every antiseptic precaution be observed and the fractured segments brought into proper position, but in suturing the skin wound an effort should be made to bring together the edges of the fascia which lies beneath the skin and which prevents the latter from becoming adherent to the underlying bones. If this is carefully done, the scarring will be much less noticeable as the indentations due to union of skin to underlying bone will be avoided. The ideal repair in these cases leaves the skin movable over the underlying nasal bones.

The following conclusions are drawn from clinical experience:

1. All injuries to a child's nose should receive careful attention and should be treated with a view to conserving its developmental forces, especially those inherent in the septum.

2. Nasal fractures in adults, especially if depressed, are best treated by means of the bridge splint.

3. In compound fractures the fragments should be brought into proper position by means of the moulding forceps and the skin wound so sutured that the fascia remains movable over the nasal bones.

SURGICAL CONSIDERATION OF THE
CERVIX UTERI*

RAFE C. CHAFFIN, M.D., F.A.C.S.

LOS ANGELES

ANATOMY AND HISTOLOGY

THE cervix is that portion of the uterus from the external os up to its junction with the corpus uteri, 1 to 1½ in. long. It is made up of muscle tissue which is continuous with that of the body of the uterus and is subject to and capable of undergoing all physiological and pathological changes that are found in the uterine body. The canal is normally lined with columnar epithelium and below this layer in the substance of the muscle tissue are numerous mucus-secreting glands. Normally, the secretion is sufficient to keep the canal and vaginal mucous membrane moistened and to prevent friction of the vaginal walls in their collapsed state. The cervix is abundantly supplied with sensory nerves derived principally from the sacral and lumbar plexes. The blood supply is derived from the circular artery which itself is a branch of the uterine artery at the termination of the internal iliac. The lymphatics of the cervix drain into the lymph vessels of the broad ligament and communicate freely with those of the tubes and body of the uterus and lie between the folds of the broad ligament. Like all smooth muscles the cervix is elastic and contractible. The important physiological changes taking place are those which occur during pregnancy and following delivery.

PATHOLOGY

INFECTION. Infection furnishes by far the greater number of pathological cervices coming under our notice. The invading organism may be of any of the pyogenic group and, less frequently, is that of diphtheria, tuberculosis or syphilis. The mechanism of the infection is an interesting one. The organism gains entrance to the vagina through coitus, douches, instruments and by continuity (colon vaginitis) and possibly by bathing. There is no age limit, infection being seen in the young nursing infant and in the aged. The invading organism, gaining entrance to the cervical canal, causes a swelling of the mucous membrane and if not destroyed rapidly finds its way to the ducts of the glands and, because of the swelling of the epithelium of the ducts, the glands no longer function but become potential abscesses.

In the milder cases the ducts are not completely occluded but continue to drain incompletely, resulting in infiltration, an increase in fibrotic tissue and hyperplasia, and hypertrophy of the mucous membrane of the canal and glands. This mild form is seen in infants, young girls and the virgin. This type of case concerns us mostly from the standpoint of mild leucorrhea, dysmenorrhea, menorrhagia, metorrhagia and reflex pain along the origin of the cervical nerves or as a focus of infection with few or no local symptoms.

The more serious infections are those of gonococci, staphylococci and streptococci usually resulting from instrumentation or trauma. The mechanism of invasion here is similar but all pathological changes are more marked and the extent of the infection depends either on its early control or the resistance of the human organism. In more advanced cervicitis, the cervix is bluish and enormously hypertrophied, oftentimes to 6 cm. in diameter, exudes quantities of mucus and is smooth to visual examination but decidedly nodular to the examining finger (Fig. 1).

On the surface are seen numerous thin,

glistening areas which are the large distended Nabothian cysts, formerly the deep cervical glands. Some may rupture from time to time only to refill in a few weeks. Each and every occluded gland may contain live organisms, as can be easily demonstrated by smears and cultures. Pus or infection under pressure results in one of two things: either the patient's resistance is so high that the bacteria are eventually destroyed or rendered non-toxic, or the patient suffers from toxemia or extension of the infection by way of the lymph channels to more remote areas, causing metritis, salpingitis, perimetritis, peritonitis, etc.

There is also a group of cases in which is found the picture just described but without definite symptoms of infection, at least as far as can be determined by ordinary examination, for the mucus is sterile. These may, however, and often do, present the symptom of pelvic pain or low backache at the origin of the nerve supply of the cervix. I have often proved this point by simple puncture, which relieves the symptoms temporarily. The pain seems to be due to local pressure of the distended gland on the nerve endings to the cervix. Our further proof comes from the patient as well as the physician who states that curetting and repair of the laceration relieves the patient of pelvic and low back pain. I attribute this relief entirely to a temporary improvement in the infection by curetting the cervix and compressing the glands by the mechanical dilator or, in the repaired cervix, to the accidental or intentional puncture of the cysts or the prevention of absorption through the everted and exposed cervical mucous membrane. Women will often have relief after puncturing the cysts and will return for a repetition of the treatment, knowing when they have become occluded. I might mention here that investigators do not agree as to the route by which cervical infection reaches the pelvic organs, whether by the uterine canal or lymphatic channels, but at the moment it seems not to matter, for all admit that the cervix must be first

infected, and that is the area with which this paper is concerned.

Trauma. The cervix is traumatized
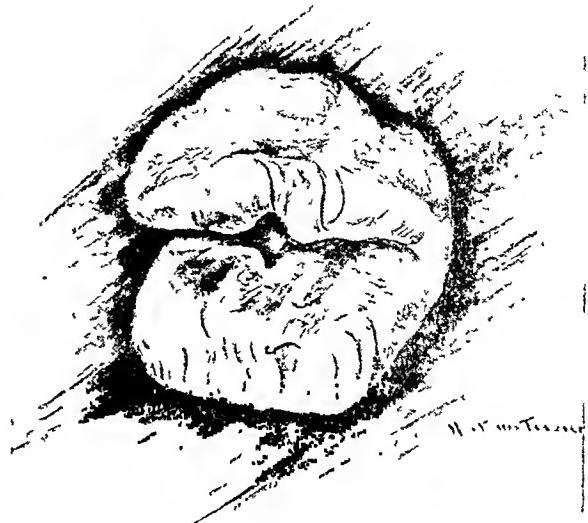
Fig. 1. Lacerated cervix with almost complete degeneration of cervical tissue. Retention cysts seen both deep and superficial.

by childbearing, mechanical dilating, instruments, curetting, pessaries of various sorts and foreign bodies in attempted abortions. The most frequent and by far the larger number are the lacerations at childbirth (Fig. 1). This leaves ragged abrasions of varying depth and number in the cervical tissue, exposing both the cervical mucous membrane and the injured glands themselves. This exposes a fertile field for the entrance and propagation of pathological organisms and although the symptoms are not particularly evident a closer examination and investigation will elicit such resulting abnormality as (1) subinvolution, (2) chronic discharge or (3) prolonged lochia flow, low back and sacral pain, menorrhagia and broad ligament tenderness and pain.

If the immediate torn surface is untreated, it is covered by scar and vaginal epithelial tissue but the lips become everted and hypertrophied and expose the delicate endocervical mucous membrane to the many infectious organisms found at all times in the vaginal vault.

NEW GROWTHS. The types most frequently seen under this classification are cancer and fibroma. We need not go into across the superior surface of the tumor. If this condition is not recognized injury may result and even then the tumor may
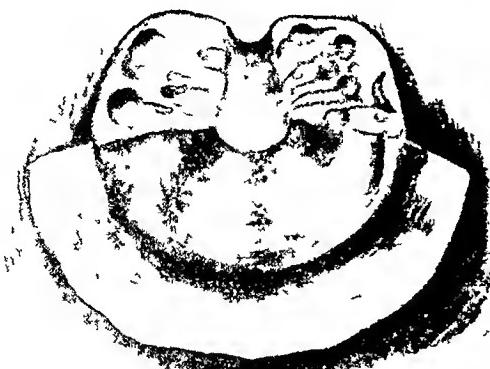
FIG. 2.
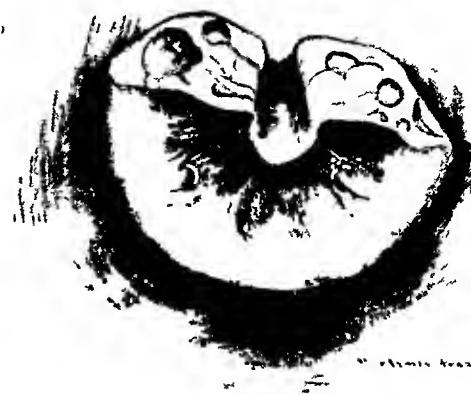
FIG. 3.

FIGS. 2 and 3. Show that many of the coring amputations are not sufficiently high to reach the deeper glands.

detail regarding cancer of the cervix, except in regard to its prevention. I think it may be said without argument that very few cervices that have not been subjected to infection or trauma become the seat of primary cancer. This point of prevention will be emphasized under treatment.

The cervix is fibrous or fibroid depending upon whether the fibrous tissue is diffuse or circumscribed. The fibrosed type has been completely described under chronic infection. The fibroid cervix may vary from a slight $\frac{1}{2}$ to 1 cm. in diameter, nodular in the canal and usually on the anterior lip, to the large fibroma completely filling the true pelvis. These are each worthy of serious consideration. The small nodule in the musculature of the cervical wall or beneath the mucosa as a polyp usually is manifested symptomatically by menorrhagia and abnormal mucous secretion. It is easily reached and the technique for removal is quite simple. The large growth is difficult to deal with because of the inaccessibility and because of the possible distortion of the anatomy of the pelvis. It is in this type of fibroid that we so often find the ureters dislodged from the posterior position and stretched

be so large that its removal from beneath may become extremely difficult.

TREATMENT

The catarrhal cervix as found in the very young is the only condition which may be treated medically with success. But it is in this particular type of cervix that medical treatment is most difficult because of the inaccessibility of the infected tissue. When it can be exposed, chemical cauterant with astringent and penetrating antiseptics are frequently curative. Diathermy has recently been applied with some degree of success. The actual cautery, grossly applied, is of value, although it should be used with great caution for fear of extensive destruction of the mucous membrane, which might possibly cause sterility and not infrequently does cause stenosis or occlusion. The knife cautery is of value and causes much less destruction of tissue but for the same reason is not as efficient as the Percy cautery. The knife, Post and other small cauteries fail in their effectiveness principally because they cool too quickly and do not carry sufficient heat to the high and deep tissues to destroy the deep glands (Fig.

11). Fulguration has been most satisfactory in my hands, and I shall explain the technique in detail later.
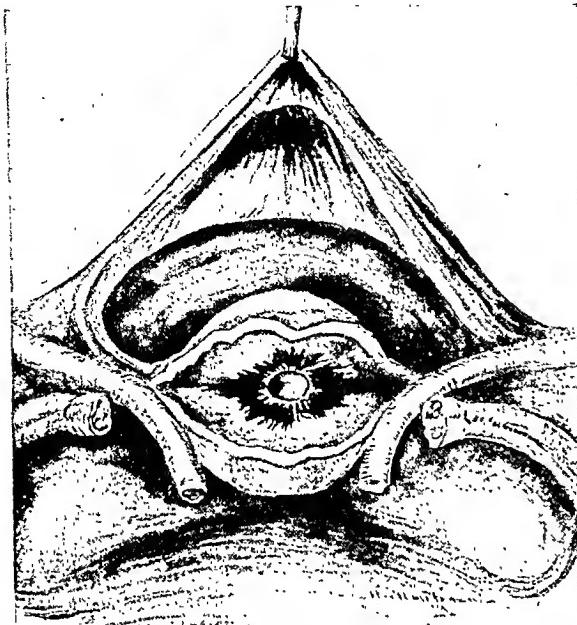
Fig. 4. Cervix cauterized from above with Percy cautery immediately after amputation of corpus.

A complete cure is effected when the cervix has returned to normal size and consistency and when the secretion is clear and transparent and not of sufficient quantity to cause an uncomfortable amount of moisture at the vulvar orifice. Many times the number and size of retention cysts are out of all proportion to the amount of excessive secretion noticed by the patient. All cervices should be carefully examined regardless of whether the patient states she has an excessive secretion. The more advanced type of cystic cervix seen in the non-virgin requires more drastic treatment.

In the beginning of the study of the patient, if we are seeking a focus of infection,[1] it is permissible to make numerous stab or puncture wounds deep into the substance of the cervix and express cyst contents with the aid of the ordinary sponge forceps. One ring blade is placed in the canal and the other at several successive points on the outside of the cervical canal and pressure applied, which maneu-

ver will express quantities of mucus or mucopurulent material. If this gives definite relief to the patient for a certain pelvic
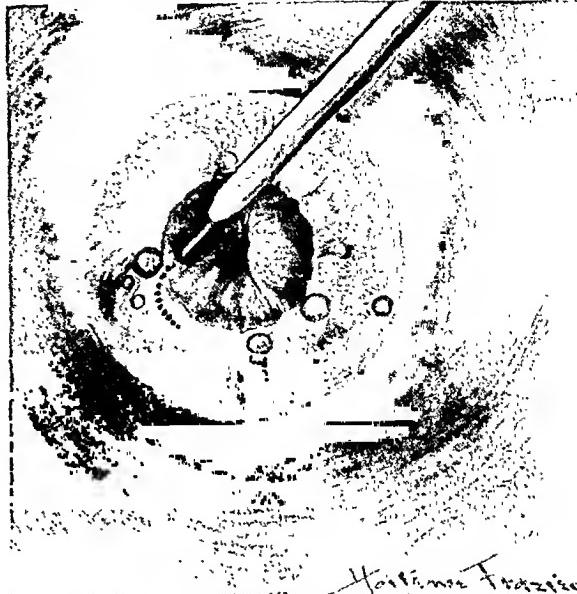
Fig. 5. Shows manner in which fulgurating electrode can be introduced into deep glands without destruction of the surface.

discomfort and low back pain, the examination should be carried still further by smears and cultures made from the gland contents. The puncture treatment, however, is not curative and more radical measures must be applied to prevent the reformation of cysts.

After carefully considering all forms and methods of treatment, it seems that the curative agent must be either some form of heat or resection. I have classified the fulguration current with the cautery. Amputation, the most radical form of treatment, also probably is the surest means of eradicating the infection but this necessitates hospitalization and a considerable period of disability. Any of the several plastic operations may be done, depending somewhat on whether or not the cervix is lacerated. In the lacerated, infected and cystic cervix, probably either the Emmett or Schroeder amputation is the method of choice. At this time I want to emphasize the importance of carefully examining the apparently simple, lacerated cervix for

deep retention cysts before doing the classical denudation for repair. This may be done by numerous stab wounds into

Fig. 6. Shows how electrode reaches any and all deep glands regardless of depth or size.

the cervical tissue and if one deep-seated cyst is found there are probably more and the repair, if done, will probably not be satisfactory either cosmetically or symptomatically. The Sturmdorff coring operation has been, in my experience, the most satisfactory of all surgical treatment in the non-lacerated cystic cervix. It does not, however, produce a complete cure, mainly because the dissection often cannot be carried sufficiently high to remove all glands (Figs. 2 and 3). Incidentally, I have first-hand knowledge of five cases of stenosis of the canal following this operation, two of which were my own. It was found necessary to dilate them from one to several times over a period of months, but all were eventually cured as soon as the canal epithelization was complete.

In our service at the General Hospital and in private practice, we have tried out the Percy cautery on a series of several hundreds of cases. These patients are all in the hospital for surgery, usually for hysterosalpingectomy or salpingectomy alone. Some few are in for repair of the outlet and, if no evidence of adnexal disease exists, the cystic cervix is treated with the cautery. The technique is that of

placing the patient in the lithotomy position with no field preparation, with weighted speculum, two Sims' lateral

Fig. 7. Inserting the electrode into the cervical tissue.

retractors, a tenaculum and cautery with the round straight point heated to redness without the rheostat. The point is thrust well up in the canal from three to five times for one to two seconds each. It is better to withdraw and reinsert so the point of the cautery farthest away from the heating element can again become hot; it cools rapidly in the tissue. Usually the cauterization should not be so radical in those patients retaining the corpus uteri as in hysterectomy patients.

For the past five years I have adopted a technique in subtotal hysterectomies of using the cautery always from above (Fig. 4). This is my rule, even though I have done a pre-operative cauterization from below. The technique is that of plunging the tip of the red-hot instrument down into the canal immediately on

amputation of the corpus. It is simple, clean and takes no more than a few seconds longer. (If not ready, a cautery

four weeks, but at the sixth or eighth week's visit they report that they are well as far as they know, and a similar report is
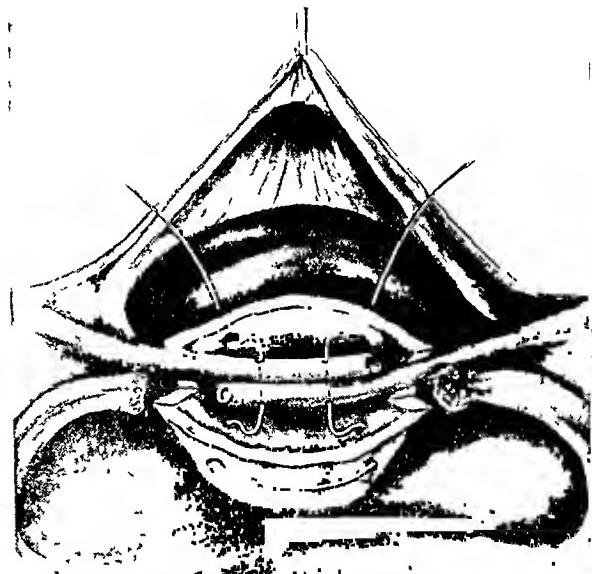
FIG. 8. Subtotal hysterectomy. Chromic catgut suture placed after amputating and cauterization of canal.
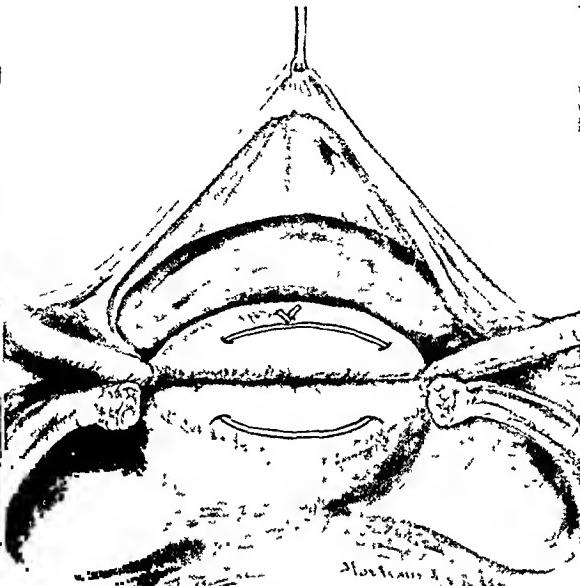
FIG. 9. Mattress suture tied, crossing round ligaments and closing lips of cervix.

will heat to a sufficient degree in three minutes.) This method controls bleeding, sterilizes the field, destroys all mucous membrane and deep infection, and in no way complicates the technique. Since using it I have had no "come back" of discharging cervices; I had many before its use and have cauterized several of these since. In my clinic at the General Hospital and in my private practice in the past year, I have seen 15 or 20 cases in which subtotal hysterectomy had been done, and the patient came in for relief of a profuse vaginal discharge. Had the cautery been used at the time of operation, the patient would have been saved the annoyance and inconvenience of retreatment and some danger of cancer.[2,3]

FULGURATION. My experience with this treatment covers about two and one-half years and between 200 and 300 cases. All cases have been followed up as far as it is possible to get the patient's cooperation. They are examined at two, occasionally four, six and eight weeks after treatment. The patient is usually not benefited under

obtained in at least 95 per cent of the cases treated. With few exceptions, treatments have all been done in my office and in the Out-Patient Gynecological Clinic at the General Hospital. The majority are treated without anesthesia, a few with gas-oxygen analgesia and some with novocaine.

Technique. Insert a wide short bivalve speculum and draw down the cervix with a hook in the canal (the hook is less painful than the tenaculum). If local anesthesia is used, infiltrate with 1 per cent novocaine around the periphery of the cervix under the vaginal cervical mucous membrane; no intracervical or canal infiltration seems to be necessary. The machine is set for 300 to 500 milliamperes which seem to be the average amount necessary, and the current is applied for from two to five seconds, except that in treating the cavity of a large cyst a longer application is necessary. All surface cysts are attacked by direct puncture, as in the use of the knife (Fig. 5). The canal and deep invisible areas are treated by the electrode from the

canal outwards, usually to a depth of ½ cm. (Figs. 6 and 7). As many as twenty or thirty stabs may be made in a few minutes

FIG. 10. Illustrates graphically the method of preparing cervix for suspension after cautery of canal.

time, and cause the average patient very little discomfort.

The patient is able to leave the office or clinic immediately, and many working women have returned to duty at once without loss of time. They are all told that the discharge will increase immediately and be blood-stained, and that no improvement is to be expected for from two to four weeks. I insist on the patient remaining in bed for two to three days during the following menstrual period because of excessive menstruation in a few patients. This is, however, no worse than is expected after any surgery on the cervix. The patient is asked to return after an interval of two weeks for examination in order to note the extent of the slough, the shrinkage of the cervix, menstrual bleeding, etc. A few cases have required two or three treatments but these had large cysts, some containing nearly a dram of fluid. It is probably much better to repeat the treatment than to attempt too much cauterization at one time, as by the

latter method the slough is greater and the danger of hemorrhage increased.

The results are obtained by tissue
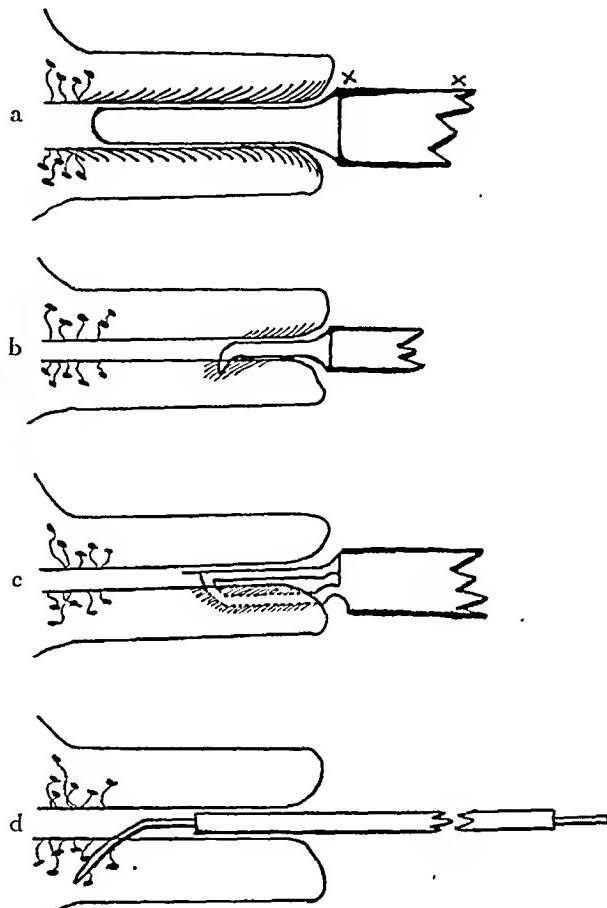
FIG. 11a. Percy cautery, the best of all cauteries. Heating element at x-x. Not sufficient heat at tip; massive destruction at external os. Shaded area indicates location and penetration of heat.
b. Post cautery. Insufficient heat, does not reach higher glands. Moisture cools point rapidly.
c. Knife cautery. Does not reach high glands. Cools quickly.
d. Fulguration electrode, no limit to height or depth of application. Degree of destruction under perfect control. The only cautery which reaches the deep glands.
Four diagrammatic drawings illustrating effects of different kinds of cautery. The shaded area in the drawings illustrates the location and penetration of heat. The only one of the four reaching the deep glands is the fulguration electrode.

reaction rather than actual destruction of the cyst areas. It seems that the advantages of fulguration over the cautery are due to the surgeon's being able to localize the agent and to apply it to considerable

depth without destroying all intervening tissue. Also the mucous membrane of the cervical canal is not completely destroyed, permitting of complete reepithelization of the canal, thereby avoiding stenosis. Five or 6 of the cases treated have had small (½ to 1 cm.) fibromas in the anterior lip of the cervix, and these were easily destroyed by inserting the electrode down to the center and applying a somewhat stronger current, much as a wart or mole is treated with this agent.

There is one more point relative to surgery of the cervix that should be emphasized, and that is adequate suspension following the subtotal hysterectomy and cauterization. It is not rare to find patients with prolapsed cervix following hysterectomy. I can highly recommend a technique I have used for the past six years which I term the "cross over mattress technique" (Figs. 8, 9 and 10). I have not been able to devise any more adequate and at the same time simpler and more easily performed method for my hysterectomies. One double No. 2 chromic gut mattress suture secures and buries the crossed ligaments between the anterior and posterior lips of the cervical stump. A simple plain suture peritonizes. I have had the opportunity of seeing a number of these cases afterwards and the pictures were all like the one illustrated here (Fig. 9). The ligaments had grown into the uterine musculature as firmly as they were ever implanted in the cornua by nature.

CONCLUSION

1. The cervix may be the seat of concealed infection for which the tonsils, teeth and many other fields have been blamed but the fact not demonstrated.[4,5]

2. The cervix should always be carefully examined and the condition noted even in the absence of pelvic symptoms.

3. All pathological cervices should be treated adequately and early.[6]

4. In the removal of gross pathology we should not forget that the cervix probably took some part in the etiology and should be treated with major surgery. If this point is kept in mind, the patient will return for final examination completely cured.

5. The Percy cautery is probably by far the best treatment for the cervix in subtotal hysterectomy and should always be used.[7] By using it as recommended, a complete hysterectomy is seldom necessary except possibly in malignancy. The mortality rate in total hysterectomy is much greater than that in subtotal hysterectomy.

6. Leaving the cervical stump is of definite value to the patient in preventing vaginal distortion and in retaining the normal pelvic diaphragm, and if properly suspended the incident of the vaginal hernia should be little if any greater than when the corpus uteri is present.

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ACUTE TRAUMATIC
CRANIOCEREBRAL INJURIES
GRAPHIC CHART USED FOR TEACHING*

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IN the treatment of head injuries it is necessary thoroughly to understand the underlying pathology responsible for the clinical signs and symptoms in order that we may anticipate processes in advance of their appearance, that sound therapeutic measures may be instituted to restore the individual to normal or prevent disaster.

Years ago a patient with a fracture of the skull was treated for fracture of the skull only. Today, however, we know that the underlying cerebral injury is responsible for the different clinical pictures. Most, if not all, of the symptoms following head injury are due to increase in intracranial pressure. Whether it be due to hemorrhage (extra- or subdural), increased secretion of cerebrospinal fluid, decreased absorption of cerebrospinal fluid, or a combination of two or more of these conditions, the results are the same: increased intracranial pressure.

The research work of such men as Cushing and his coworkers, Frazier, Sachs, Sharp, Coleman and Dowman, has stimulated widespread study, with subsequent thorough understanding of head injuries and the institution of sound therapeutic measures for their relief.

The treatment of acute craniocerebral injuries today is that of conservatism. First the patient is treated for shock, if present, by the usual methods applicable to the treatment of this condition wherever encountered. When the patient has recovered from his shock, dehydration is indicated to combat the development of increased intracranial pressure. Dehydration is produced by the administration of hypertonic solutions intravenously and a hydragogue cathartic given by mouth or rectum. This is supplemented by operation when indicated.

In teaching students the pathology of cerebral injuries and the underlying changes responsible for the clinical phenomena found, it is difficult to portray by word pictures the different pathological changes, the pathological physiology, the most appropriate treatment, and the time for its institution. To surmount these difficulties, the accompanying chart was constructed. It has been gratifying to find that students who use this chart have a fair knowledge of the pathology of head injuries and the fundamental indications for treatment.

EXPLANATION OF CHART

For convenience we have divided the clinical picture of head injuries into six stages, representing the phenomena produced by the increase of intracranial pressure with subsequent changes in pulse rate, blood pressure, and cerebrospinal fluid pressure.

STAGE 1. This represents the stage of shock, when every effort should be made to secure the return of the patient to normal by therapeutic measures, i.e., modern treatment for shock. If intravenous infusion is indicated, we prefer to give a 50 per cent solution of glucose, which produces an increase in the blood volume by virtue of the bulk of the solution itself, as well as by dehydration from the tissues into the vascular tree. It will be noticed that in Stage 1 there is a fall in blood pressure and an increase in pulse rate, the spinal fluid

pressure, however, being above normal. In severe craniocerebral injuries the patient rapidly passes from Stage 1 into Stage 6

in determining the spinal fluid pressure and the character of the spinal fluid, whether clear, bloody or xanthochromatic, and
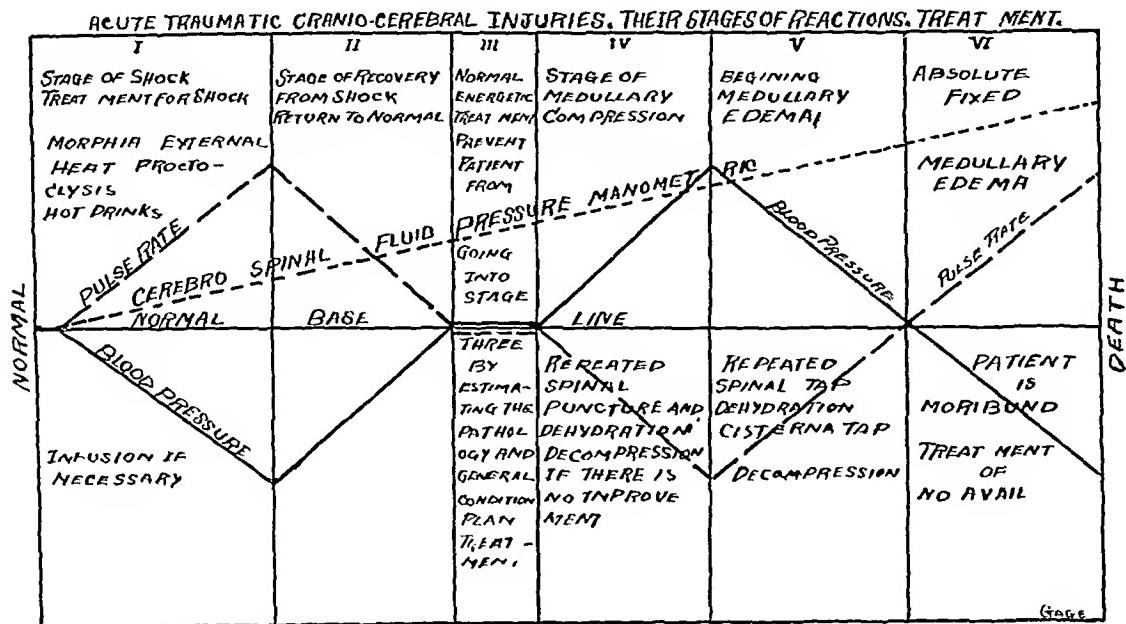
FIG. 1.

———— Blood Pressure
- - - - - - Cerebrospinal Fluid Pressure
— — — Pulse Rate

without passing through the intervening stages. When once he reaches Stage 6 the patient rapidly succumbs.

STAGE 2. Here we see a return to normal as regards pulse rate and blood pressure, the two criteria denoting recovery from shock. This stage represents the favorable results following the therapeutic measures used to overcome the condition of shock seen in Stage 1.

STAGE 3. This stage we believe to be the most important, the pulse rate and blood pressure having returned to normal. In slight craniocerebral injuries the patient remains in this stage for a short time and rapidly recovers. In the more severe cases he passes through Stages 1 and 2, the blood pressure and pulse rate returning to normal in Stage 3. Complete physical examination, including roentgenograms of skull, neurological examination and any special examination deemed necessary, is followed by active therapy. Spinal puncture in this stage is of utmost importance

these factors are the indications for treatment. This stage is represented by normal pulse rate and blood pressure; however, the patient may or may not be unconscious. The spinal fluid is usually under increased tension. We recently had an example of this stage, when 2 patients were admitted to the hospital twenty-four hours after receiving head injuries. Both were unconscious; blood pressure and pulse rate normal; the cerebral spinal fluid, however, showed a pressure of 30 mm. of mercury and was bloody, demonstrating the unreliability of pulse rate and blood pressure in determining the increase of intracranial pressure, and showing also the importance of estimating the cerebrospinal fluid pressure by the manometer. Both patients entirely recovered after conservative treatment, having never passed beyond Stage 3.

We believe and teach that patients should never pass beyond Stage 3, if prevention of this is possible. In other words, this is the period for energetic

treatment designed to promote the return of the patient to normal.

STAGE 4.   This is the stage of medullary compression and is characterized by slowing of pulse rate and rise of blood pressure. In this stage intracranial pressure has increased rapidly and has produced medullary compression. This possibility should be anticipated in Stage 3 and its occurrence prevented, if possible. If there is no improvement in twenty-four to forty-eight hours under conservative treatment, i.e., dehydration by the use of intravenous glucose and magnesium sulphate by mouth or rectum, subtemporal decompression is indicated. We believe that in this stage it is not advisable to wait too long before resorting to operative interference if conservative therapy fails.

STAGE 5.   In this stage the patient rapidly passes from beginning medullary edema to absolute fixed medullary edema.

In incipient medullary edema, as shown by a fall in blood pressure and a rise in pulse rate, energetic treatment may turn the tide in favor of recovery; however, the margin of safety between early medullary edema and complete medullary edema is very small. We believe that when a patient has been seen early and treated adequately he should never reach this stage. Here our entire armamentarium should be used; dehydration, spinal puncture, cisterna puncture and decompression may restore the normal condition.

STAGE 6.   In Stage 6 the patient shows all the phenomena of a fixed medullary edema. Treatment in this stage is of no avail.

The chart which the author has devised for purposes of visualizing the pathology of head injuries and their treatment is shown in Figure 1. It represents a graphic picture of the phenomena taking place in acute traumatic craniocerebral injuries.

RIVANOL DEXTROSE

A NEW ANTISEPTIC FOR APPLICATION TO THE MUCOUS SURFACES OF THE URINARY TRACT*

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THE chemical compound rivanol was first introduced into this country in 1921 from Germany. At this time the therapeutic results were satisfactory in the hands of the few who tried it, but the irritating qualities were so great that its use was abandoned. About one year ago its German originators succeeded in eliminating its irritating qualities by combining dextrose, 2 parts, to 1 part of rivanol lactate, the original preparation.

Rivanol dextrose was worked out by Morgenroth along the same chemotherapeutic principles as conceived by Ehrlich, and implied a systematic search for chemical substances with a strong affinity for parasites and a weak affinity, or possibly none, for cells of the host.

Rivanol together with acriflavine belongs to the acridine group but is superior in that it has less toxicity and great antiseptic powers. The construction of this dye was given as
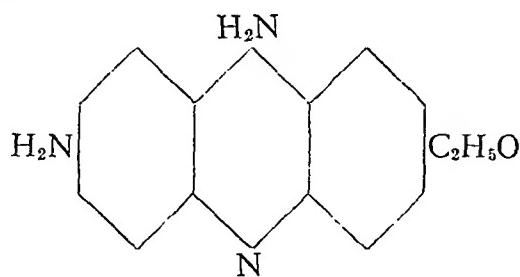
and the soluble hydrochlorate was used.

Morganroth's description is as follows: a light yellow fine crystalline powder, soluble in approximately 260 parts of water at 25°C. and 28 parts of hot water. The solutions are yellow and fluorescent but darken when exposed to light for several days. The aqueous solution is stable to boiling. The reaction to litmus is neutral. The dextrose is added to the rivanol lactate to increase solubility and to prevent irritation. Our clinical results obtained in the treatment of acute gonorrhea indicate that the dextrose also activates the rivanol.

Morgenroth determined the antiseptic power* of rivanol in living tissue. A dilution of 1:40,000 sterilized an experimental streptococcus which showed phlegmon in the subcutaneous tissue of the mouse within twenty-four hours. In the test-tube streptococci were destroyed in the presence of serum by concentration of 1:100,000, this giving the favorable antiseptic index of $40,000/100,000 = 1/2.5$. In staphyloc cic infections the index was greater than 1, the ideal index being 1.

The lethal dose for the rabbit is 100 mg. for each kilogram of body weight if given subcutaneously, and 50 mg. if given intravenously. This slight toxicity permits the use of large amounts of the diluted concentration in man. Rivanol has proved to have a strong affinity toward the cocci group and has been used clinically as a tissue antiseptic in such cases as localized pyogenic abscesses, pleural empyema, peritonitis and joint infections. In this article we are most concerned with its use as an antiseptic on the mucous membrane of the urinary tract.

In studying the therapeutic use of this dye, we have made a study of the comparative toxicity of neutral acriflavine (trypaflavine), rivanol lactate and rivanol lactate dextrose (1 part rivanol, 2 parts

* The absolute antiseptic index is a ratio between the antiseptic concentration of a drug in vivo and in vitro, the ideal index being $\frac{1}{1}$, when the action of the drug in the living tissue is not inhibited in comparison with that in the test-tube.

dextrose) when injected intravenously into the albino rat.

Healthy, non-pregnant albino rats weighing 90 to 140 gm. were employed. The rats were obtained from one source and were kept on a constant well-balanced diet (a mixture composed of whole wheat meal, 53.5 per cent; corn meal, 10 per cent; skim-milk powder, 33 per cent; calcium carbonate, 0.5 per cent; sodium chloride, 1 per cent, and cod-liver oil, 2 per cent) for two weeks before the tests. They were fasted for from sixteen to twenty hours immediately before the administration of the drugs, when they were weighed and the doses administered per kilogram body weight. The solutions of the drugs were prepared with freshly distilled water and were administered within two hours from the time of preparation. A 1 per cent solution of the acridine dye was employed. The injections were made into the saphenous vein at the rate of 0.1 c.c. solution every fifteen seconds. All animals that lived were observed for six days when they were killed and carefully necropsied.

TABLE I

TOXICITY OF NEUTRAL ACRIFLAVINE 1 PER CENT SOLUTION

Rats Employed	Killed	Per Cent	Mg. Solution per Kg. Body Weight
3	0		50
3	0		60
3	2	67	70

Two of the animals that received 60 mg. per kilogram and all three rats that received 70 mg. per kilogram developed convulsions at the end of injection.

The intravenous maximal tolerated dose and fatal dose of neutral acriflavine is 70 mg. per kilogram. Death occurred in asphyxial convulsions within five minutes after injection. At necropsy the skin, subcutaneous tissues (including muscles) and viscera except liver and spleen were heavily stained yellow. The lungs were distended and congested and contained petechiae. Blood taken directly from the heart showed extensive agglutination of erythrocytes and a yellow precipitate several times the size of an erythrocyte.

The animals that lived were apparently normal within a few minutes after injection. They gained in weight during the observation period (six days). They were then killed. The necropsies were negative.

TABLE II

TOXICITY OF RIVANOL LACTATE 1 PER CENT SOLUTION

Rats Employed	Killed	Per Cent	Mg. Solution per Kg. Body Weight
3	0		40
3	0		60
3	0		80
3	1	33	100
3	3	100	120

Two of the animals that received 60 mg. per kilogram and all of the animals receiving 80 mg., 100 mg. and 120 mg. per kilogram developed asphyxial convulsions at the end of the injection.

The intravenous maximal tolerated dose of rivanol lactate is 100 mg. per kilogram and the fatal dose is 120 mg. The death at 100 mg. per kilogram occurred within twenty-four hours and the deaths at 120 mg. per kilogram occurred immediately in asphyxial convulsions at the end of the injection. The skin, subcutaneous tissues (not muscles) and viscera except spleen were faintly stained yellow. The lungs were distended and congested. Blood taken directly from the heart showed agglutination of erythrocytes, possibly some hemolysis, and a yellow precipitate. The animals that lived were apparently normal within twenty-four hours. All gained in weight during the observation period (six days) except those receiving 100 mg. per kilogram. They were then killed and necropsied. The necropsies were negative except for the animals that received 100 mg. per kilogram. The kid-

neys of these animals showed definite nephrosis and the liver of one was swollen, mottled greyish yellow, and friable.

TABLE III

TOXICITY OF RIVANOL LACTATE-DEXTROSE MIXTURE 3 PER CENT SOLUTION

(RIVANOL LACTATE, 1 PART; DEXTROSE, 2 PARTS)

Rats Employed	Killed	Per Cent	Mg. Solution per Kg. Body Weight
3	0		40
3	0		60
3	0		80
3	2	67	100

Two of the animals receiving 60 mg. per kilogram and all of the animals receiving 80 mg. and 100 mg. per kilogram developed asphyxial convulsions at the end of the injection.

The intravenous maximal tolerated dose and fatal dose of rivanol lactate dextrose mixture was based upon the amount of rivanol lactate injected in 100 mg. per kilogram. Death occurred in asphyxial convulsions immediately after injection. Necropsies are the same as after rivanol lactate alone.

The animals that lived were apparently normal within twenty-four hours. All gained in weight during the observation period (six days) except the animal receiving 100 mg. per kilogram. At necropsy one of the rats receiving 80 mg. per kilogram showed slight nephrosis and the rat that received 100 mg. per kilogram showed moderate nephrosis. The necropsies were otherwise negative.

The fatal dose of neutral acriflavine is 70 mg. per kilogram when injected intravenously into the albino rat as a 1 per cent water solution. The fatal dose of rivanol lactate is 120 mg. per kilogram and the fatal dose of the rivanol lactate dextrose mixture based upon the amount of rivanol lactate injected is 100 mg.

Neutral acriflavine and rivanol lactate agglutinate the erythrocytes and form yellow precipitates when injected intra-venously into the albino rat as a 1 per cent water solution. The addition of 2 per cent glucose to the rivanol lactate solution does not influence this agglutination or precipitation.

Although our work with this dye is recent and rather limited, we feel that the results obtained over the silver salts and other acridene derivatives are sufficiently creditable to warrant a recital of our experience.

Rivanol dextrose solution was used for irrigations of urethra and bladder in concentration of 1:5000 and, if well tolerated, was increased to 1:3000. For acute infections of the urethra, 1:1000 solutions were used as an instillation.

Table IV will give some idea of the results of treatment which we have been following in a small series of cases over a limited time:

The diseases treated were confined to infections of the urethra and bladder, being gonorrheal, mixed infectious or tubercular in type. There were 20 cases of acute gonorrheal anterior urethritis. These were treated by daily anterior instillations of rivanol dextrose 1:1000. Fifteen, or 75 per cent, were pronounced cured after five weeks' treatment, that being the period of time considered sufficient to insure a cure. In general, the gonococci disappeared within ten days, the variation being from four to eighteen days.

The purulent discharge disappeared in 1 case after the first injection, in 2 after the third and in 3 after the fourth. In 6 other cases purulent discharge had disappeared by the tenth day. The 3 other cases had a recurrent discharge from three to four weeks after treatment started but these were scanty and noticeable usually in the morning and all were well at the end of five weeks. The other 5 cases did not yield well to treatment. One case showed gonococci organism for four months and developed prostatic and posterior urethral complications. The 4 remaining cases developed posterior urethritis with persistent discharges, but repeated examinations of the

TABLE IV

CHART OF CASES TREATED

Diagnosis	No. of Cases	Duration of Regular Treatment	Successful Treatment		Av. Disappearance Specific Organisms	Variation of Disappearance Specific Organisms	Disappearance of Purulent Discharge					Variation of Disappearance of Purulent Discharge
			Cases	Per Cent								
Acute anterior gonorrheal urethritis .	20	5 weeks	15	75	10 days	4–18 days	1 day / 1 case	3 days / 2 cases	4 days / 3 cases	10 days / 6 cases	10–28 days / 3 cases	1–28 days
Post-urethritis mixed infection . .	5	3–5 months	3	60	Complications: 2 chronic prostatitis. 1 chronic prostatitis and cystitis							
Tuberculous cystitis	3				Improved, symptoms greatly relieved, 3 cases, capacity of bladder increased							
Chronic prostatitis	30				Improved with massage and irrigation with rivanol dextrose							
Pyelitis . ..	10	6 weeks			8 cases showed definite improvement in symptoms							

smears were negative for gonococci after five weeks' treatment. These uncured cases were evidently of a mixed infectious origin and seemed to respond best to a combination therapy of rivanol and silver salts used as irrigations first of the bladder then in a more concentrated solution as anterior and posterior instillations.

Three cases of tuberculous cystitis were treated at this time, using rivanol dextrose, 1:5000, as an irrigation. This proved especially effective as compared to the results of previous treatments with acriflavine and the silver salts solutions. It has a great analgesic, antiphlogistic and secretion-diminishing action in severe forms of cystitis. The anodyne action was especially remarkable in these cases and under the influence of rivanol dextrose the inflammatory catarrhal manifestations improved rapidly, the sclerotic changes became diminished and the capacity of the bladder greatly increased. We have also been using rivanol dextrose as a posterior instillation in treatment of prostatic infections, but are unable to give any valuable information as to the results in these cases, other than to say the results are equal to those with any other preparation we use.

Numerous cases of cystitis of mixed infectious origin responded to treatment in a similar manner as those cases of cystitis mentioned above, the urine clearing up rapidly and the symptoms usually being relieved.

Recently we have begun a routine irrigation of our pyelitis cases with rivanol dextrose, 1:2000, and have had definite improvement in most cases. The time during which we have been using this treatment has not been sufficiently long to form accurate conclusions.

SUMMARY

1. The chief value of rivanol dextrose in infections of the urinary tract as seen in clinical observations, aside from the possible sterilizing properties by a non-toxic and non-caustic agent, is the building up of an antiseptic wall between the focus and the general circulation by means of circular infiltrations around the progressing infection.

2. Rivonal dextrose has marked efficiency in the treatment of acute gonorrheal urethritis with its accompanying analgesic action and relief of symptoms.

3. Lack of toxicity permits the use of large amounts of the diluted solution.

4. Transparent and stainless properties are valuable.

FAT IN TRAUMATIC EFFUSIONS OF THE KNEE JOINT*

DAVID H. KLING, M.D.

LOS ANGELES

DURING a study of effusions the presence of fat in hemorrhagic fluids aspirated from the knee joint was observed. This condition was new to the writer and no account of it was found in the literature. Therefore, an investigation was made of the appearance, the source, and the significance of fat in traumatic effusions of the knee joint, the results of which are submitted in this paper.

APPEARANCE

Fat was found in bloody knee-joint fluids only. When present in considerable amount it can be discovered without difficulty. If the fluid is poured into a dish, the fat droplets will be seen on the surface, much like fat "eyes" in bouillon. If a bottle containing the fluid is shaken, fat will stick to the walls and form a turbid film. Small amounts of fat and fat particles which are solid at room temperature (palmitin and stearin) can be recognized by centrifugalizing the fluid for five to ten minutes. The centrifuge tube offers a very characteristic appearance (Fig. 1). The fluid is separated in three or four layers. Blood corpuscles form the sediment at the bottom of the tube.

The second layer is liquid and contains the serum which is yellow or reddish colored, according to the degree of hemolysis present. The fluid may be either clear or turbid when flocculi of mucus are floating or fat droplets are emulsified in the serum. This layer is the largest and makes up from one-half to three-fourths of the contents of the test-tube.

The third layer is solid, whitish colored, and consists of the neutral fats, palmitin and stearin, which have a melting point of

66°c. and 69°c. respectively. They form a skin at room temperature, like cream on milk.

The fourth layer is liquid yellowish, and consists of olein which has a melting point of −4°c. It is variable in thickness, depending on the amount of olein. Considerable amounts of olein form a distinct fourth layer of oily fluid. In tube B (Fig. 1), the liquid fat is about ¾ in. thick and nearly twice the size of the third, solid layer. In effusions which contain only small amounts of olein the fluid will be separated in three layers only, as in tube A.

The line of separation between blood corpuscles and serum is very sharp and is well marked between the other layers.

The fats in fresh fluids give the physical and chemical reactions of neutral fats (esters).

If a centrifuge is not available, the sedimentation and separation in the different layers can be observed by simply placing the aspirated fluid in a narrow test-tube from twelve to twenty-four hours.

SOURCE OF THE FAT

1. The pyramidal space (Fig. 2) between the patella (above), the tibia (below) and the patellar ligament (front) is filled by a thick pad of fat. Two triangular fringes, the plicae alares, project into the joint cavity from the medial and lateral margins of the patella. They converge in the middle line and form a narrow band of fat, the plica synovialis patellaris, which crosses the joint cavity and is attached to the intracondyloidal notch of the femur in the neighborhood of the anterior crucial ligament. The fat pad and its fringes are within the joint capsule but outside of the

*From the Laboratory of the Golden State Hospital. Submitted for publication June 19, 1928.

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synovial membrane. The latter reflects and folds over the plicae alares and forms a sheat around the plica synovialis.
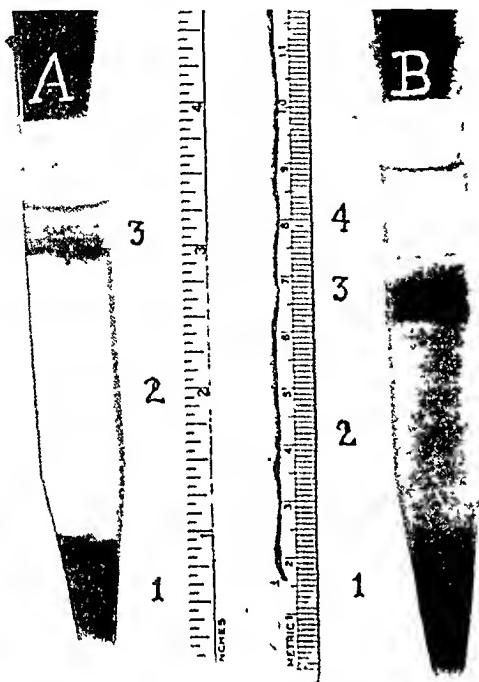
FIG. 1. Two specimens of hemorrhagic fluid from the knee joint, containing fat. A. Centrifugalized in three layers, serum clear, small amount of olein. Separated into four layers, large amount of olein: (1) blood corpuscles; (2) serum; (3) solid fat (palmitin and stearin), and (4) liquid fat (olein).

2. A variable amount of fat is enclosed in the synovial sheath of the crucial ligaments, especially at the point of their attachment to the bones.

3. The red bone marrow of the epiphysis of femur and tibia contains, besides blood and giant cells, some fat deposits.

Each of the three fat depots is, therefore, in close approximation to, but outside of, the central cavity of the knee joint. When fat is present in this cavity and demonstrated in the aspirated fluid, we are entitled to assume that the synovial membrane has been torn or the articular surface of the bones fractured and the marrow opened.

Other deposits in the region of the knee joint do not contribute fat to the aspirated fluid.

There is some fat around the suprapatellar bursa but it is outside of the capsule and well protected against injuries. The

writer has not observed to date fat in fluids from this bursa, but in case it should occur, we must make sure that it did not
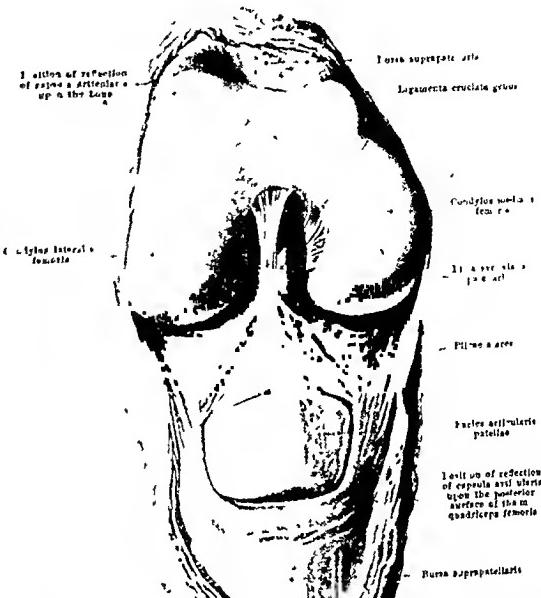
FIG. 2. Fat pads of the knee joint. (*From Spaltebolz's Hand Atlas of Human Anatomy.*)

originate in the central cavity and reach the bursa through a communication.

The prepatellar and infrapatellar bursae are separated from the knee joint. There are holes in the posterior wall of the capsule at the entrance of the blood vessels which are filled with fat particles. This wall, however, is not exposed to the common injuries and fluid accumulating in the posterior pouch can not be aspirated from the front.

SIGNIFICANCE

Diagnostic Consideration. In a series of 15 cases of injuries to the knee with hemorrhagic effusions fat was found in 6 (39.6 per cent) and was absent in 9 (60.4 per cent) of the fluids. The diagnosis in the latter 9 cases was: suprapatellar bursitis, 2; prepatellar bursitis, 5; synovitis, 2 cases. Roentgenograms were negative and symptoms of injury of the internal ligaments and cartilages of the joint were absent in these cases. The centrifugalized fluids were separated in two layers; at the bottom a sediment of blood corpuscles, followed by a more or less hemolytic, clear or turbid serum.

The clinical diagnosis of the 6 cases with fat present in the effusion was:

1. Rupture of the internal semilunar cartilage.

2. Rupture of the internal semilunar cartilage and anterior crucial ligament.

3. Detachment of internal semilunar cartilage.

4. Infraction of external spine of tibia, rupture of posterior crucial ligament.

5. Infraction of intercondyloid notch of the femur, rupture of anterior crucial ligament and mucous ligament.

6. Infraction of medial spine of tibia and medial condyle of femur and rupture of both crucial and external collateral ligaments.

All 6 cases suffered an injury of the internal ligaments or cartilages of the knee joint. Three cases were complicated by fractures of the articular surfaces of femur and tibia. The aspirated fluid centrifuged in three or four layers as described above.

The importance of the finding of fat in knee fluids is made evident by a comparison of this group and the first series of cases where blood alone was aspirated.

Bleeding is not symptomatic for a severe or extensive injury of the knee joint and it does not indicate the site of the damage in the synovial membrane. Different bursae were involved in the first 9 cases.

Fat, on the other hand, is indicative of a severe injury where the synovial membrane of the central cavity has been torn and the interjoint ligaments and cartilages damaged, eventually combining with a fracture of the articular surfaces. The latter point will be decided by roentgenography. The writer found the amount of olein (fourth layer) relatively high in the cases complicated by fractures.

A consideration of the blood supply of the knee joint will explain the entirely different significance of the finding of blood and fat in traumatic effusions of this part. A dense net of vessels (rete articulare genu) supplies all pouches, folds and bursae. Hence, a small tear at any point of the synovial membrane

causes bleeding, the amount of which depends on the condition of the vessels as much as the size of the tear. Heart and kidney conditions, hypertension, arteriosclerosis, lues and diabetes make the vessels vulnerable. Hemorrhage is, finally, not exclusive proof of a previous injury. Bloody effusion in the knee joint can be an early sign of hemophilia. Also sarcoma of the synovia and capsule can produce an hemarthrosis. These affections may be rare but they are of diagnostic interest and importance in deciding liability in compensation cases. But the fat depots which are exposed to trauma are located around the central pouch of the knee joint and in the close neighborhood of the interjoint structures. Fat is not known to be affected by the mentioned conditions.

Only a severe trauma which produces extensive damage to the synovial membrane of the central cavity and to the interjoint structures or articular surfaces of the knee joint is able to tear particles of fat from the depots and deposit them in the joint cavity.

While the differential symptomatology of knee injuries has been worked out thoroughly, it is still a matter of considerable difficulty to recognize the nature and extent of injury in the acute stage when the joint is very painful and distended by a large amount of fluid. Examination of the fluid for the presence of fat will supply valuable information and help solve diagnostic and prognostic problems.

Pathogenic Consideration. Blood is slowly resolved and absorbed in serous cavities, but we know nothing of the way in which fat could be eliminated there. Enzymes which accelerate hydrolysis of fatty esters (esterases) were found in all tissues but only traces of true lipases were discovered outside of the pancreas and intestines. Fat, especially the solid components, palmitin and stearin, may precipitate in the joint cavity and in consequence undergo organization. This explains the formation of loose bodies, consisting of fibrous fat after injuries. It induces, therefore, a chronic pathological condition

which prevents the restitution of the normal function of the knee joint.

Therapeutic Consideration. Traumatic effusions were formerly not touched and the knee joint was immobilized for a considerable time. Recently the authors on this subject recommend early aspiration, repeated in case effusion recurs. This procedure together with early mobilization prevents atrophy, restores the tonus of the capsule and removes clots and fibrin which tend to precipitate. This method of treatment is fully supported by the discovery of fat in severe injuries and the possibility of organization of fat particles with formation of loose bodies in the joint cavity. It is proved that the aspiration is not connected with any danger of infection when the ordinary aseptic precautions are taken, and is harmless even in septic and tuberculous effusions.

As an illustration, two histories will be abstracted briefly, the first a case of internal derangement alone, the second combined with an interjoint fracture.

CASE REPORTS

CASE I. W. L., white, aged thirty-nine, butcher, slipped and fell on a piece of ice in the refrigerator on December 15, 1927. He hurt his left knee but was able to finish his work and walked home, a distance of several blocks. In the evening he noticed that the knee was markedly swollen and very painful. Next morning he was transferred to the hospital. There was no previous injury or inflammation of this joint.

Examination found the knee joint very much swollen and extended. All movements were painful; the knee was locked in partial flexion. There was marked tenderness over the inner knee joint. The roentgenogram revealed no injury to the bones.

Diagnosis was rupture or dislocation of internal semilunar cartilage.

Forty cubic centimeters of bloody fluid were aspirated. Upon being centrifugalized it separated into three layers. At the bottom was a layer of blood corpuscles $\frac{1}{2}$ in. thick, above which was a layer of cloudy serum 4 in. thick. The cloudiness of this layer was due to suspended fat. On the top was a thin skin of solid neutral fat.

After aspiration the knee was extended fully. A snapping sound was heard during this manipulation.

CASE II. P. H., white, aged twenty-four. While unloading iron beams on February 1, 1928, the patient was struck by a falling pile. The right knee was injured so that he could not raise it. He was transferred to the hospital.

Examination showed the knee joint and the adjacent tissues swollen. All movements were painful. Superficial abrasions were found on the anterior surface of the knee. The roentgenogram revealed infraction of the internal condyle opening in the knee cavity with slight displacement of the fragments, and an infraction of the inner spine of the tibia and abnormally wide separation between the outer condyle of the femur and the corresponding fossa tibiae.

Diagnosis was intercondyloidal fracture of the femur and fracture of the medial spine of the tibia, with rupture of both crucial and external collateral ligaments.

Fifty cubic centimeters of hemorrhagic fluid were aspirated. Numerous fat droplets floated on the surface of the fluid. In the centrifuge the specimen separated into four layers. At the bottom were blood cells to a depth of $\frac{1}{8}$ in. Next there was a layer of clear reddish serum 2 in. thick, covered by a skin of white solid fat $\frac{1}{8}$ in. in thickness. The top layer was liquid, lemon yellow in color, about $\frac{3}{4}$ in. thick, and was composed of olein. Physical and chemical reactions were positive for neutral fat.

SUMMARY

1. Fat was observed in traumatic hemorrhagic effusions of the knee joint.

2. Fat is conveniently discovered by centrifugalizing the aspirated fluid. It accumulates on the surface and causes separation of the fluid into three or four layers.

3. The interjoint fat depots and the bone marrow of the epiphyses are the source of fat in the aspirated fluid.

4. The fat indicates an injury of the interjoint structures (crucial ligaments and semilunar cartilages) alone or combined with fracture of the articular surfaces.

5. Fat particles torn and deposited in the joint cavity may be organized and form loose bodies.

6. Early aspiration is indicated.

RUDIMENTARY HORN PREGNANCY*

WITH REPORT OF CASE

Abraham Koplowitz, m.d.

BROOKLYN

PERHAPS no field of congenital anomalies presents such a confusion of terminology as that referring to anomalies of growth of the female generative organs. Frequently different names have similar meanings. For instance, the term uterus unicornus, while anatomically restricted to asymmetry of development with absence of Fallopian tubes, is also applied to designate those cases showing a rudimentary horn and tube.

Embryologically, the uterus, tubes and vagina are formed by the proper development and proper fusion of the two Müllerian ducts, which fusion takes place from below upwards. Lack of fusion, resulting in an anomaly varying in degree from the uterus arcuatus to the uterus didelphis where there exist two separate uteri, cervici and vaginae, accounts for most of the anomalies. Rudimentary development of one of the ducts accounts for the rest.

We are concerned in this paper with that failure of development of one of the ducts resulting in a rudimentary horn attached to an apparently normal uterus, so far as appearance shows, or a uterus apparently onesided (unicornis), evidently developed of one Müllerian duct though with a complete cervix and vagina.

According to Aschoff's classification of asymmetric hypoplasias and aplasias of the uterus, this is called uterus bicornis cum acornu rudimentaria. That is, one duct is fully developed, the other defective in vagina and cervix and situated as a rudiment on the other half of the corpus uteri. Eden and Lockeyer, for the same condition, use the term uterus unicornis with rudimentary horn. De Lee's term, terus bicornis unolatere rudimentaria, seems perhaps most appropriate because most expressive.

The rudimentary horn is usually situated on the right side, though no reason seems to be known for this. Most frequently a well-developed tube and ovary are attached to it and the round ligament is usually attached to this horn close to the body of the uterus. This connection of the rudiment with the rest of the corpus is usually by a pedicle to the upper angle or towards the middle of the body of the well-developed uterus. This band gives a direct communication with the rest of the uterine cavity in about 20 per cent of the cases on record, though Humpstone, quoting Brooke Wells, claims that a much greater percentage would be found if a more careful search were made, asserting that a microscopical study of cross sections of the pedicle might reveal a sufficiently large canal to permit a passage for a spermatozoon.

The rudimentary horn has a mucosa identical with the endometrium and is continuous with the tube on that side. It may cause hematometra and hematosalpinx and may become the seat of pregnancy. This may occur through the opening in the pedicle, if one exists, or by transperitoneal migration of the spermatozoon if the ovum is from its own side, or of the impregnated ovum if from the opposite side.

From the time of Mauriceau and Vassal in 1669, who reported the first case, De Lee states that there were 100 cases reported up to 1916. Wardlaw and Smith have collected some more to 1922. Quain in 1913 claimed to have collected 150 cases from the literature, though he admits that the incompleteness of some of the reports and general confusion of terms would make that number much less. Thus he quotes Kehrer in 1900 reporting 82 cases, and Cohen, in 1909, 50 more, though many were

questionable on account of confusing nomenclature.

Guillaume in 1911 tabulated 145 cases, not claiming to have exhausted the literature. However, a study of his work tends to show that several cases included were really uterus bicornis or uterus subseptus. It is quite remarkable how few have been reported by American surgeons, the first being by Paul Munde, in 1890.

Of all the cases reported, about 30 are said to have gone to full term. But a closer study of these advanced cases have convinced Quain that this number is much too high. Several authors have described a dead fetus which had died at "term" while as a matter of fact either the history would tend to show that the fetus had died a month or more before term or the description of the specimen would fail to prove a development to full term.

The conclusions as to the length of the pregnancy must rest very largely on the examination of the fetus, the actual size being of less importance than the development of special tissues and organs. Quain's case unquestionably lived to term, as shown not only by the history but by the physical examination of the fetus. Skiagraphs showed advanced bone development, especially the centers of ossification of the lower epiphyses of the femurs.

Scott and Forman reported one of the most interesting cases on record where 2 full-term fetuses were retained in a rudimentary horn for twenty years. The pregnancy from which this resulted occurred after two living children were born and was followed by the birth of another living child.

Humpstone in 1920 reported 2 cases, 1 of about four months, which gave a typical history and findings of ectopic pregnancy which had ruptured, and a second, which was admitted as a full-term pregnancy in eclampsia, the peculiar anomaly being discovered at the cesarian operation which followed. It is interesting to note that he had the same experience as we did in the first case the writer reported, that is, in attempting to perform a vaginal hysterotomy, the surgeon,

Dr. Harvey Matthews, unexpectedly found himself in the peritoneal cavity. According to Humpstone these cases divide themselves in two classes: those in which pregnancy terminates in four to five months by rupture and hemorrhage (about 90 per cent of the whole) and those in which there is sufficient musculature in the rudimentary horn to allow enough hypertrophy for the condition to go to, or near, full term, when an attempt at labor sets in.

Even then, rupture may take place, with escape of the fetus into the abdomen, but the hemorrhage is not as severe as that occurring in a tubal rupture, because the muscular cyst walls retract, compressing the torn blood vessels and firmly grasping the contained placenta after the escape of the fetus. When rupture does not occur, labor soon ceases, death of the ovum takes place and absorption of fluids quickly reduces the mass in size.

A clinical diagnosis of pregnancy in such a horn has been made in but few instances before operation. Among these were those of Draghiesco (quoted by Cohen), Hoene, Knauer and Wehle (quoted by Guillaume), and Lindner in 1904. Since 1922 the only cases reported in German and English literature were those by Kriwsky, of a nearly full-term pregnancy, and by D'Arcy of a full term, both in 1925. A fair review of American literature disclosed only 12 cases altogether, with 3 full-term cases among them: Munde in 1890, Wells in 1900, Webster in 1904, Frankenthal in 1910, Quain (full term) in 1913, Schwartz in 1915, Scott and Forman (full term) 1916, Humpstone in 1920 (one full term), and my own in 1928 (eight months).

These cases are by no means all the cases met with, as a good many are not reported, for instance, in a discussion of Webster's case, Emil Reis stated that he had operated on 2 such cases that he had not reported.

CASE REPORT

Mrs. S. K.,[1] aged thirty-six, was admitted to the hospital on November 6, 1927, with the following history.

[1] Case No. 25706. B. E. N. Y. Hospital.

She was of a robust type and had always been well. She had had eight pregnancies which were attended by a midwife. They were uneventful; each terminated spontaneously and in normal deliveries. There were no periods of relative sterility and there were no abortions, spontaneous or otherwise. Her menses began at the age of thirteen and were regular, of a twenty-eight-day type, bleeding for three to four days, and unassociated with pain, excessive or intermenstrual bleedings. Her last regular period was three months prior to admission to the hospital.

During this period of amenorrhea she suspected that she might be pregnant, although she felt perfectly well. On the day of admission to the hospital at about 4 P.M. she was seized suddenly with sharp lancinating pains in the lower abdomen, marked weakness and fainting spells. Two hours later she began to bleed per vagina. The weakness was progressive, becoming extreme, but the pain did not abate. Dr. Krieger, who was called to see her, made the diagnosis of ruptured ectopic pregnancy and rushed her to the hospital.

The physical examination on admission revealed the following: Temperature 97°F. Pulse rate 60. Respiration 18. Blood pressure 78/60. The abdomen was distended and tender all over, especially over both lower quadrants. There were no masses palpable and there was an absence of peritoneal rebound. Vaginally she showed a fair parous introitus, small closed cervix, and the uterus could be felt by the examining finger beyond the cervix but could not be completely made out. It did not give the impression of being enlarged. Fornices and cul-de-sac were extremely tender, but there was no evident fluctuation.

The laboratory report was as follows: Blood: hemoglobin 58 per cent, R.B.C. 2,800,000, W.B.C. 11,000 with a differential of 70 per cent neutrophiles, and 30 per cent lymphocytes.

Diagnosis of ruptured ectopic, pregnancy, probably interstitial in type, was made.

With this history and these findings operation was decided upon and performed immediately. On opening the abdomen and after inspection, the following were noted: The uterus was normal in size and centrally located. To the right of the uterus and attached to the right cornua by a musculo-fibrous band was a structure which appeared like another uterus with a rent in it about 5 cm. in length, from which placenta and cord were protruding. The

right tube and ovary were attached to this structure and the left tube and ovary, normal in every way, were attached to the uterus first described. Free blood and many blood clots, together with a fetus the size of a two and a half to three months' gestation attached to the cord, were found free in the abdomen. The structure containing the rent and the right tube and ovary were removed. Three hundred cubic centimeters of a 10 per cent solution of glucose were left in the abdomen and 450 c.c. of a 10 per cent solution were given intravenously.

The patient reacted completely and did well for eight days, when the temperature rose suddenly to 103.6°F. She complained of pain in the left side and the spleen could be palpated. Diagnosis was made of splenic infarct. She recovered completely and left the hospital eight days later (sixteen days postoperative) in excellent condition.

The specimen removed was examined by Dr. R. Frank, who reported the following, and made the accompanying drawings based on the specimen and the report of findings at operation:

The specimen consists of one half of a uterus bicornis, the horn of the uterus being 6 cm. long, 5.5 cm. wide and 2.5 cm. at the base removed from the other horn. A right Fallopian tube, normal in size and appearance, occupies one side. The abdominal ostium of this tube is normal and open. The tube takes a somewhat anomalous course at its uterine end, running superficially on the posterior surface of the fundus and then penetrating into the uterine musculature, approximately 0.3 cm. from the edge.

Below this tube is a normal ovary containing only an old, well-involuted corpus luteum, evidently antedating the pregnancy by a number of weeks. The fundus in gross appearance closely resembles a normal fundus except that at the usual site at which the left adnexa should be, is a large circular defect about 2 cm. in diameter, penetrating into the interior of the uterus and occupied throughout its circumference by chorionic tissue. No evidence of left adnexal insertion can be found. The basis of attachment of this uterine horn contains no canal (this was confirmed by microscopic section of this area). An almost circular cavity occupies the inside of the uterus. This cavity is lined by endometrium and communicates with the tube (microscopically confirmed).

In addition a free piece of placental material

about 7 by 1 cm. in size was included in the specimen.

The fetus is 10 cm. long, apparently male in

FIG. 1.

sex, attached to a cord 15.5 cm. in length, evidently between two and two and a half months in age.

The fact that no fresh corpus luteum was found on the involved side makes it evident that fertilization had taken place through the cervix of the left, evidently pervious cavity, and that the ovum rose from the left ovary,

was taken up by the right tube and implanted in the right horn, which had no cervical outlet. In the further course of the gestation, rupture
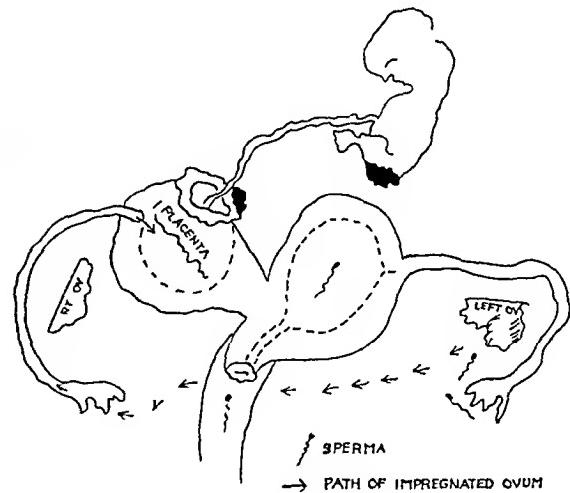
FIG. 2.

of this horn took place into the abdominal cavity.

This then is a clear case of transmigration of the ovum across the peritoneal cavity.

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RENAL PELVIS OBSTRUCTION

DUE TO ABERRANT VESSELS*

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THE origin of anomalies of the renal vessels was not definitely determined until Jiedel and Bremer made some embryological investigations in 1915. Their conclusions were:

1. The anomalies of the renal artery depend on vessels present in the embryo or upon the aorta and its larger branches which develop from the mesodermal coats from which there are no late branches.

2. Certain anomalies are due to the persistence of the early renal blood supply most frequently seen in pelvic kidneys that is, the renal artery has a branch from the iliac, inferior mesenteric or the middle sacral artery or from the aorta below the middle mesenteric artery.

3. A periaortic plexus of vessels with many roots from the aorta exists, affording the opportunity for the change in position of the main aortic branches and supply of the smaller branches for possible future use.

4. The renal artery is derived from this plexus. The channel for the permanent renal artery is selected mechanically. Channels not so convenient may be utilized if the usual channel is occluded, hence the renal variations and anomalies. These changes take place while the kidney is migrating from its original embryonic pelvic position to its permanent one.

Some authorities believe that this anomaly in all its different types exists in 20 per cent of cases, but Mayo and Eisendrath report the condition to exist in about 2.5 per cent of cases.

Ekeham in 1907 was the first to direct attention to the part which the accessory vessels to the lower pole may play in the etiology of hydronephrosis.

The inferior polar artery branching from the main renal artery is a very rare condition and only one or two cases have been reported. Inferior polar arteries from the aorta are the most common and are the outstanding etiological factor in obstructing the flow of urine down the ureter, resulting in a distended pelvis of the kidney, hydronephrosis and calculus formation. The aberrant artery may also arise from the iliac and even from the middle or inferior mesenteric. Eisendrath states that lower polar arteries from the aorta, renal and iliac arteries are present in one out of every 185 kidneys.

In this series of 9 cases, 2 cases were hypernephromas:

CASE I. A man aged forty-four, complained chiefly of pain in the left costovertebral angle, radiating to the back with hematuria of one month's duration. Hematuria and pain had become progressively worse. The patient had lost weight gradually. Cystoscopy showed the left kidney full of blood and pus· and of very low function. Nephrectomy was performed for hypernephroma. A large aberrant vessel entered the kidney half way between the pelvis and lower pole.

CASE II. A man aged fifty-eight, complained chiefly of blood in the urine, pain in the right flank and frequency of micturition. The symptoms had been present for ten weeks. There was general weakness. Cystoscopy showed a very low kidney function on the right side. Nephrectomy was performed for hypernephroma and aberrant vessels were found running to the anterior surface of the lower pole. These vessels resulted in some obstruction to the flow of urine but were in no way the etiological factor causing the malignancy.

. There were three cases of hydronephrosis:

CASE III. A man, aged fifty, entered the hospital complaining of pain in the left loin and hematuria, which he said had been present since 1898, varying in duration from one day to two weeks with intervals of no bleeding for months, nocturia three times, frequency during day. Cystoscopy revealed a large damaged left kidney. Nephrectomy was performed. The aberrant vessels in this case were imbedded in a thick fibrous band running to the anterior surface of the lower pole.

CASE IV. A man aged forty, came in complaining of indigestion and mass on the right side, and dull pain radiating to the right flank. The patient was sent at first to the medical ward and finally referred to the genitourinary service for cystoscopy and pyelography. Cystoscopy revealed no urine or dye coming from the right kidney in thirty minutes. Nephrectomy was performed. In the perirenal tissue at the ureteropelvic junction was a band of tissue which at first was thought to be a double ureter but later proved to be an aberrant vessel running to the anterior surface of the kidney at the lower pole, coursing transversely to the long axis of the ureter in such a way as to form a blockage at the ureteropelvic junction. On dissection of this band of tissue, three vessels were found.

CASE V. A man, aged thirty-five, entered the hospital complaining of pain in the left kidney region for the last twenty years, but decidedly worse for the past few weeks, dragging in character, aggravated by taking alcohol and acid foods. There was no hematuria, but a slight amount of frequency during the day and some nocturia. Nephrectomy was performed. A large aberrant vessel was found running to the lower pole and causing a great deal of pressure on the ureter, thereby blocking the flow of urine.

Four cases of calculi were found with some existing hydronephrosis:

CASE VI. A man, aged fifty, entered the hospital complaining of pain in right lumbar region dating back one year, followed by hematuria which lasted one week and then disappeared, then returned one month ago. Pain was becoming more severe and was closely associated with the hematuria. Cystoscopic examination revealed urine filled with pus coming from the right kidney; no blue appeared in twenty minutes. Nephrectomy was

performed. The vessels were found to cross posterior to the ureter just below the ureteropelvic junction. This condition was thought by the operator to be the cause of the existing hydronephrosis and calculus formation. Because of the large size of the vessel, it was felt that its ligation would cause atrophy of the lower pole of the kidney. This possibility, along with the presence of a hydronephrosis and calculus and an excellent kidney on the opposite side, indicated nephrectomy.

CASE VII. A man, aged fifty-four, entered the hospital complaining of a pain in the left kidney region for the past four months, dull aching in character, and severe colicky attacks, but with no hematuria, frequency or urgency. Cystoscopic examination showed a diminished function with pus in the left kidney. Pyelotomy was performed and a calculus removed. The aberrant artery was present at the lower pole just below the ureteropelvic junction. It was also accompanied by a vein.

CASE VIII. A man, aged fifty-nine, entered the hospital complaining of pain in the right kidney, loss of weight and nocturia. Symptoms had been present for the last six months, aggravated by exercise. Nocturia and frequency were marked. The patient had lost 40 to 50 lbs. Cystoscopy revealed a large amount of pus coming from the right kidney, but no blue came through in thirty minutes. Nephrectomy was performed. An artery was found running to the upper as well as to the lower pole. The operator did not believe that the vessel caused any obstruction to the ureter.

CASE IX. A man, aged forty-eight, had been suffering from a pain in the left kidney region for the past year and a half with some hematuria following severe colicky attacks which radiated down the course of the left ureter. Cystoscopic examination revealed pus and blood coming from the left kidney and a diminished amount of blue. This patient also gave a history of having passed a stone with hematuria about one year ago. Pyelotomy was performed and a stone was removed from pelvis of the kidney. A large vessel running to the anterior surface of the lower pole of the left kidney was found. This vessel held the ureter down tightly and caused a marked retraction in the pelvis. This was a very excellent demonstration of the blocking that may be caused by an aberrant vessel. When the vessel was raised from the

ureter, the pelvis of the kidney readily emptied itself.

In these cases the aberrant vessels all came from the aorta. In the four calculi cases, the calculus was in the pelvis of the kidney in every case. In three of the cases (Cases I, II and VIII) the operator did not believe that the existing aberrant vessel was in any way responsible for the pathology, but in the other cases it was felt that the vessel was the mechanical factor causing the existing condition. Therefore, one may observe that vessels to the lower pole of the kidney do not always cause obstruction of the ureter, resulting in hydronephrosis and calculi formation, but in a great many instances they are responsible for the pathology found in the kidney.

In ligating these vessels, especially if they are large or many in number, one thinks of the possible atrophy of that portion of the kidney which the vessel supplies, but the actual damage caused will never be known as we are unfortunate in not being able to follow these cases in later years to the autopsy table.

DISCUSSION

Dr. WILBOLZ (University of Berne, Switzerland): I was particularly interested in the cases of hydronephrosis with abnormal vessels, which I always propose to treat as long as possible in order to conserve the kidney. We can only conserve it when we have opportunity to observe the case very early, and therefore we must appeal to the general practitioner to send us these cases as early as possible. I am sure that when these vessels are cut there will always be a necrosis of the lower pole of the kidney, and later there will be a diminishing of the function and a great scar in the lower pole. When these vessels are not cut, plastic on the pelvis is all that is required, and this is not very difficult. The ureter must be cut, and then in spite of sparing the vessels the ureter can be pushed behind the vessel and there will be no more pressure. I have cases two, three, and four years after operation in which the pelvis is working very well. The function is not quite normal but it has improved and remains favorable for many years, so that we can be sure that in many of these cases we will be able to save kidneys which otherwise would have to be nephrectomized later on. For this reason I make this appeal to try more conservative work in these normal vessels with hydronephrosis.

SUBSEROUS CHOLECYSTECTOMY*

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TOTAL extirpation of the gall bladder by the classic method is fraught with grave risks because of the impossibility of properly closing the cystic duct. Exposure of the cystic duct in the usual operation for cholecystectomy necessitates a great deal of gauze packing, with pressure and traction on the viscera. This traction and pressure usually causes such shock to the patient that a long, stormy, uncomfortable convalescence is the result.

There have been many types of procedure suggested to overcome these defects, but none of them give the results in my hands that a modification of Doyen's subserous method for enucleation of the gall bladder does.

The late Dr. Albert Chambers and I, working on cadavers fifteen years ago, saw that the serous coat could be easily stripped from the gall bladder with the result that it could be skinned back and down to the cystic duct. By this means there was no possibility of confusing the cystic and the common ducts. The cystic duct could be ligated and left inside of the original serous sack of the gall bladder, thus giving protection to the duct and to the surrounding viscera, in preventing adhesions as no raw surfaces are exposed. In addition there was no injury to the bed of the liver so there should be no bleeding.

Doyen, in 1899 seems to have been the first operator to realize the ease of subserous enucleation of the gall bladder. In his "Surgical Therapeutics" he describes an operation for it. Since that time the value of the operation seems to have been lost. Although there have been several other methods for subserous dissection suggested during the past few years, the chief points of value of this method are:

1. The ease with which the operation can be performed.

2. The small amount of shock to the patient, resulting from lack of trauma to the bed of the liver and celiac plexus.

3. The excellent exposure of the cystic duct and the impossibility of clamping the common duct by mistake.

4. The small amount of retraction needed for the exposure of the gall bladder.

5. The few instruments needed for the operation.

6. The remarkably smooth and rapid convalescence.

7. Lack of need for drainage.

TECHNIQUE

The incision used is a modified Mayo. If the viscera in the region of the gall bladder is to be explored and the appendix is to be removed, the Mayo incision is not quite long enough. On several occasions I have found adhesions to the duodenum which on slight traction have torn. Due to the excellent exposure obtained by the longer incision, the leaking of the duodenal contents was immediately detected and easily sutured.

By placing a small round pillow under the small of the patient's back, the under surface of the liver is given better exposure. Using the modified Mayo incision enables the skin and fascia to be drawn apart better and often no retraction is necessary to view the gall bladder. However, it must be remembered that this pillow is to be removed before attempting to close the wound, as neglecting to do so will cause a great deal of unnecessary strain in closing.

The incision starts at the ensiform cartilage and goes down following the free border of the ribs to the mammary line and then goes caudad for an inch and a half, or longer, if the appendix is to be removed through the same incision.

In stout patients the fascia is divided crosswise and in lean ones lengthwise, using fingers as retractors and blunt dissectors. The oozing is checked by warm saline gauze and pressure.

The peritoneum is opened just over the gall bladder, which usually presents itself without the aid of retractors. The fundus is picked up with an Allis clamp. After careful examination, the surrounding viscera are gently packed off with a warm saline Boston pack. A circular incision is made through the serous covering of the gall bladder just below the Allis clamp, and the serous layer is separated from the gall bladder either with the handle of a scalpel or a finger covered with gauze. The serous covering is stripped back down to the junction of the cystic and the common ducts. Then placing the third finger of the right hand as close as possible to the common duct, outside of the serous covering, the contents is milked as far back towards the fundus of the gall bladder as possible. A Kelly clamp is applied to the cystic duct just below the contents. A small longitudinal incision is then made in the cystic duct just below the Kelly clamp and after walling this field off with a small warm saline pack, a blunt probe is passed down the cystic duct, into the common duct and into the duodenum, sounding for stones or obstruction. If a stone is found it is removed with the aid of various sized curettes. Making certain that there are no obstructions the cystic duct is then ligated below the incision. It is sutured and anchored and a second suture placed just a little below, using No. 2 catgut for both. The gall bladder is now amputated just below the Kelly clamp. The small pack is removed and oozing is looked for. The serous coating of the gall bladder which has been stripped off is folded back and the incised end is brought together with three stitches. The large Boston pack is then removed and the abdomen closed layer by layer with No. 2 catgut. The skin is closed with interrupted silk stitches and three silkworm gut stitches through skin and fat for reinforcement.

I have performed the operation 50 times. There have been in this series of cases no operative mortalities, no second operations for adhesions and no hernias. The following case histories indicate the small amount of shock the patient suffers.

CASE HISTORIES

CASE 1. St. Agnes' Hospital No. 42,974: white, female, aged forty-eight, single.

Present illness: For over a year the patient has been suffering with pains which radiate from the region of the liver, up to the right scapula. This pain is clinching in character and there is warmness under the ribs. The pain is more severe at times than others.

Past history: Pneumonia in infancy. Small growth removed from abdomen eleven years ago. Typhoid fever eight years ago. Family history: Negative. Gastrointestinal: Considerable gas forming lately. Menses began at eleven years, regular twenty-eight day type. Pain several days before.

Physical examination: Abdomen, no palpable masses. Tenderness over the gall-bladder region. No rigidity. The cramp-like pain described above is just to the right of this tender area. No jaundice. Blood pressure, 128/85. Urine, negative. Roentgen-ray examination: Gall-bladder region not visualized.

Diagnosis: Gall stones.

Operation: July 20, 1927. Cholecystectomy. (Dr. Mortimer. Assistant, Dr. Matthey. Ether, Dr. Keech.)

Operative note: Incision was begun at ensiform cartilage and followed the free border of the ribs to the mammary line and down ½ in. Gall bladder easily located. Serous covering encircling the fundus incised. Serous covering stripped back. Cystic duct clamped, incised and probed. Gall bladder amputated and delivered intact. Stump touched with carbolic and ligated with No. 2 catgut. Serous covering drawn over the stump and fastened with No. 3 catgut sutures. Abdomen closed through and through with No. 2 catgut, skin reinforced with two silkworm gut sutures. No drains.

Patient stood the operation well and was returned to her room one hour and fifteen minutes after leaving it.

Post operative note: At the end of twelve hours the patient was slightly uncomfortable and there was a little vomiting. After twenty-four hours she was expelling flatus freely and

complained of shortness of breath. In thirty-six hours she was vomiting a small amount of bile and the shortness of breath was still

mouth but he did not bite his tongue. This third attack lasted one half hour but he was dazed for an hour after regaining consciousness.

Fig. 1.
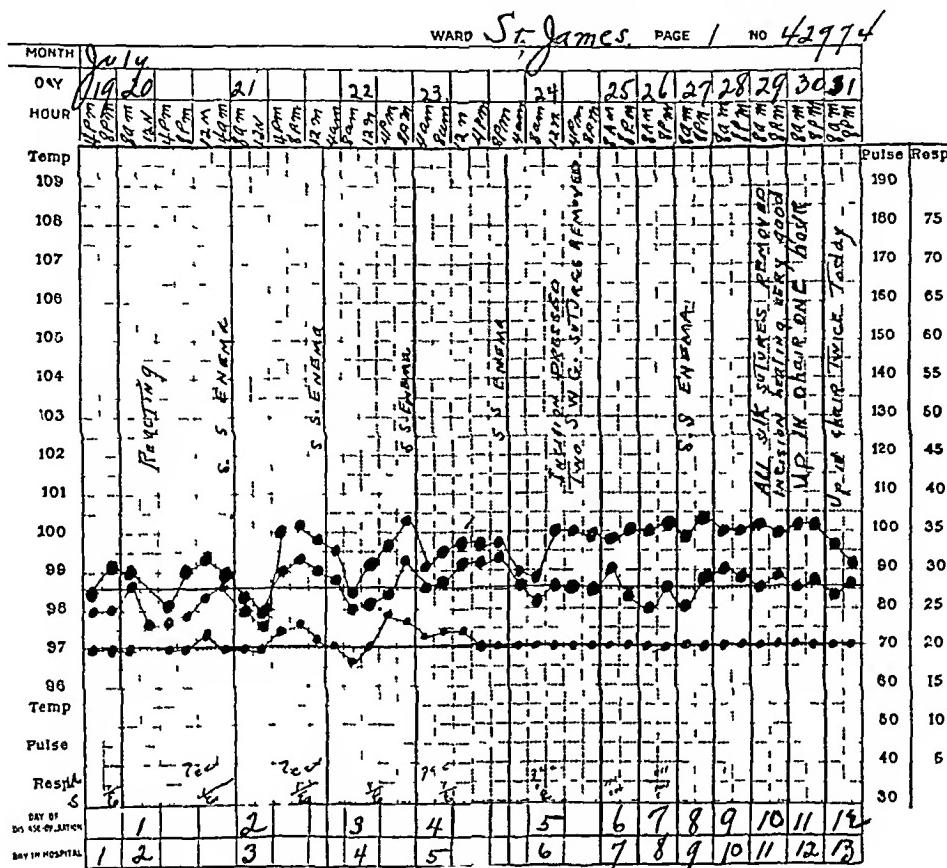
present; however, she had passed a fairly comfortable night. After forty-eight hours she was fairly comfortable and was on a liquid diet. On the third day she was slightly nauseated, passed flatus, but was fairly comfortable; soft diet. Daily enemas returned dark brown. On the fourth day she had a formed stool and passed a very good day. She was up on the eleventh day in a chair and was discharged on the fourteenth day. One year later, well.

CASE II. St. Agnes' Hospital No. 44,930. White, male, aged sixty-four.

Present illness: First attack five years ago. He became unconscious while eating and remained so for one hour; was in convulsions. He foamed at the mouth but did not bite his tongue. There were premonitory symptoms; he felt dazed following the attack. Two years ago he had a similar attack and a third one the night before admission. He went into convulsions; there was excessive saliva from the

He had been having frontal headaches for two weeks and shooting pains in the occipital region. Vision became blurred momentarily.

Past history: Usual childhood diseases. No serious illness. Seen in consultation two years ago for kidney colic. Had been treated for ulcer of the stomach; was undernourished. Seen again in March 1928, complaining of heart attack following acute indigestion. Had an attack of angina pectoris following the first attack of unconsciousness; two days before admission he had a smothering sensation in the upper thorax after exertion.

Family history: Mother died of tuberculosis, aged sixty-three. Father died of apoplexy, aged sixty-one. Three sisters died of tuberculosis. No history of epilepsy in family.

Physical examination: Well developed and nourished white male. Heart slightly enlarged, sounds regular in rate and rhythm but very feeble. No apparent murmurs. Abdomen, moderately obese. On palpation there is slight

tenderness over McBurney's point. Dullness, on percussion, slightly below the costal margin and to the right of the ensiform cartilage. Liver is not enlarged. Moderate arteriosclerosis. Blood pressure; 148/100; blood count, R.B.C. 5,560,000. W.B.C. 10,600. H.G.B. 85; blood sugar, 125 mgs., Wassermann, negative; urea, 36 mgs. normal of 18 mgs; urine, normal. Few epithelial cells.

Roentgen-ray Examination: March 17, 1928. Gall-bladder region. After the oral ingestion of sodium tetraiodophenolphthalein, fourteen and one-half hours after the ingestion of the dye and two hours after eating, the gall bladder was not visualized. There were no positive stone shadows.

Fluoroscopical examination of the chest shows moderate dilation of the arch of the aorta. Heart not enlarged. Moderate fibrosis of the lungs.

Diagnosis: Gall stones and appendicitis.

Operation: March 19, 1928. Cholecystectomy, appendectomy. (Dr. Mortimer. Assistant, Dr. Matthey. Ether, Dr. Keech.)

Operative note: Incision was begun at the costal cartilage, down following the free border of the ribs to the mammary line and then down approximately 3 in. Fascia was separated crosswise; muscles separated by blunt dissection; peritoneum opened with longitudinal incision. There were many adhesions in the region of the gall bladder and it was difficult to locate. On palpation we found what we thought to be the gall bladder imbedded in the liver. Grasping the fundus with an Allis clamp, but still in doubt of the mass, we made an opening and removed one large stone (the size of a guinea hen's egg), a number of small stones and considerable mucus. The serous covering of the gall bladder was stripped down to the cystic duct and a sound passed through the cystic and common ducts. No adhesions or obstruction found. The cystic duct was tied and amputated near the common duct. No. o catgut was used. The serous covering of the gall bladder was replaced with three stitches. Large and small packs were removed.

The left hand was then passed to the region of the cul-de-sac and the appendix brought into view. Mesoappendix and all adhesions were tied. A Pagenstecher suture was applied and the appendix amputated with cautery; stump was inverted. Abdomen was closed through and through with No. 2 catgut; silk was used in skin and five silver wire sutures through skin

and fat for reinforcement. Patient was given 1000 c.c. of saline while on the table.

Gross pathology: The specimen consisted of a gall stone about the size of a marble, egg-shaped, corrugated, very friable. On section it was crystalline and golden yellow.

Postoperative note: The day following operation there was no nausea and the patient had passed a comfortable night. On the second day he passed flatus. He was very comfortable and desired nourishment. Given soft diet in seven days and after ten days was on regular diet. Up in a chair on the fifteenth day and discharged from the hospital on the twenty-first day in excellent condition.

Three months later. Patient reported he is feeling better than he has felt for ten years.

CASE III. St. Agnes' Hospital No. 44,799. White, female, aged twenty-seven, married.

Present illness: Referred for vaginal odor and discharge. Pain under right scapula; tenderness over the gall bladder; vomiting. Pain comes on after eating; stools have been clay and slate colored.

Past history: Laporotomy three years ago. Appendix, both tubes and part of both ovaries removed. The gall bladder was then found full of stones but owing to the patient's condition the stones were not removed. Was advised to have hysterectomy in two years. I did a curettage and cauterization of the cervix and the patient was relieved for four months, but the odor then returned and was even greater. By this time she had attacks of gall-stone colic which were so severe she consented to another operation.

Family history: Mother living, had a hysterectomy at age of forty-seven. Otherwise history is negative. Menses began at age of thirteen. Missed half of the time; irregular; painful. Relieved by operation for about one year but then trouble returned. Marital: One child six years old. She had one miscarriage about six weeks before admission.

Physical examination: There is tenderness over the entire abdomen which is more marked over the region of the gall bladder. No rigidity; no palpable masses; no jaundice. Blood pressure, 132/75; blood count, R.B.C. 4,120,000; W.B.C. 10,400; H.G.B. 85.

Diagnosis: Gall stones. Degenerated uterus.

Operation: February 27, 1928. Cholecystectomy. Hysterectomy. (Dr. Mortimer. Assistant Dr. Matthey Ether, Dr. Keech.)

Operative note: The incision was begun at the ensiform cartilage, carried down the lower border of the ribs to the mammary line and then down one-half inch. The gall bladder was easily located. The fundus was grasped with an Allis clamp and the surrounding viscera packed off. The serous covering of the gall bladder was incised, encircling the fundus, stripped back to the cystic duct and then the duct was clamped. A small incision was made into the cystic duct and a probe passed down into the common duct. No obstruction found. The cystic duct was tied and anchored with No. 2 catgut and the gall bladder amputated intact. The stump was reinforced with two catgut sutures. The serous covering was drawn over the stump and secured with three catgut sutures. The wound was closed in the usual manner with No. 2 catgut for deeper sutures, silk in skin and reinforced with two silkworm gut sutures.

Mid line incision was then made parallel to the old scar and a hysterectomy done in the usual manner. The patient stood the operation very well. Was given 1000 c.c. of normal saline subcutaneously while on the table.

Post operative note: After twenty-four hours the patient had had a fairly good day; some pain; fed by Murphy drip; voided every four hours; given small doses of morphine. On the second day, expelling flatus. There was slight headache and some nausea. Given $\frac{1}{2}$ grain of codeine. Light diet on the third day. In six days the patient was comfortable on light doses of codeine. Out of bed on the twelfth day for an hour. Discharged from the hospital on the sixteenth in good condition.

Case IV. (Case I. NGBS. March, 1915.) White, female, aged twenty-six, married. Two children.

Diagnosis: Acute cholecystitis. Cholelithiasis.

Operation: March 15, 1925. Cholecystectomy. (Dr. Mortimer.)

Modified Mayo incision. The gall bladder had ruptured but was well walled off. The remnant of the fundus was grasped with an Allis clamp and the surrounding area walled off with gauze packs. Fifty-two stones were removed. The serous covering was stripped back to the cystic duct. The cystic duct was ligated and anchored; the serous covering was then drawn back. A rubber drain was placed in this field and the abdomen closed in the usual manner with No. 2 catgut for deeper layers and silk in skin.

Post operative note: The drain was removed on the fifth day. On the twelfth the patient was discharged from the hospital in good condition, walking.

Thirteen years later, the patient reported that she has been well and has had three children since the operation.

SUMMARY

Subserous enucleation of the gall bladder by Doyen's method is advantageous for the following reasons:

1. It gives an excellent exposure to the cystic duct, rendering confusion with the common duct impossible.

2. It requires no traction on retractors.

3. It leaves no raw surfaces for adhesions to form.

4. It permits removal of the gall bladder and contents intact.

5. It permits probing of the common duct for stones and stricture.

6. It does not necessitate tying the cystic artery.

7. It causes no injury to the bed of the liver and there is no hemorrhage from this point.

8. It requires no drainage.

9. The lack of trauma insures a comfortable and speedy recovery with the minimum amount of shock to the patient. Absence of nausea and pain.

10. The modification of Mayo's incision in conjunction with the pad permits a better exposure without retractors which causes less need for packing and in turn less trauma to the celiac plexus.

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SUPERNUMERARY GALL BLADDER*

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BROOKLYN

THERE are many anomalies of the gall bladder and ducts. Such structural deviations, while interesting anatomically, also may have considerable clinical and surgical importance.

Cases of accessory gall bladder are extremely rare. In an exhaustive study of the clinical, autopsy and comparative anatomical data on the subject, Boyden in 1926 found that while the condition is relatively common in certain animals, notably cats, only 20 instances in human beings had been reported between 1674 and 1926.

In considering these 20 cases of accessory gall bladder, Boyden classified them as follows: (1) vesica divisa, or bilateral gall bladder; 2. vesica duplex, or double gall bladder, with two cystic ducts. The latter was further subdivided as: a, Y-shaped, in which the two cystic ducts unite before entering the choledochus, and the gall bladders, usually adherent, occupy the same fossa; b, ductular type, in which the two cystic ducts empty separately into the common bile duct. The two gall bladders, generally separate, may occupy different lobes.

Of the ductular type there are only 4 represented in the series. The earliest account was by Blasius in 1674. A possible instance was reported in the *Philosophical Transactions*, 1693–94. The next example was observed by Purser in 1886. The fourth case was reported by Professor Lambert of the University of Alabama in a personal communication to Dr. Boyden. He identified two separate bladders, the accessory one being an "outgrowth of the common duct in the form of a small saccular appendage presenting all the structural conditions of the gall-bladder." It was located half a centimeter or more from the junction of the main cystic duct with the choledochus.

Sherren, in 1911,. Schachner in 1916 and Nichols in 1926, described double gall-bladders, some containing stones; but the exact terminations of the two cystic ducts were not revealed.

The following case is reported as a supernumerary gall bladder of the ductular type, making the fifth of that classification.

CASE REPORT

History: The patient, female, aged nineteen, was admitted to the Jewish Hospital of Brooklyn, May 2, 1927, complaining of intermittent pain in the right hypochondrium over a period of nine years.

At the age of ten the patient first experienced slight gnawing pains in the upper part of the "stomach." These early attacks lasted but a few minutes. During that first year she had four distinct attacks. They recurred through the next two years with increasing frequency and severity. Several radiographic studies were made of the gastrointestinal tract and of the gall bladder. No abnormality was demonstrated.

Four years later, at the age of fourteen, the patient had an attack of epigastric pain that persisted for an hour. It was diagnosed as an inflammation of the gall bladder. The following year and a half the attacks continued with less severity, but with distress after eating and a sense of fullness as from undigested food. A roentgenological examination then made disclosed possible gall-bladder calculi, and an operation was advised.

At sixteen the patient had the most severe attack of pain which lasted seven hours and was associated with vomiting of a greenish

FIG. 1. Showing the position and relative size of the rudimentary gall bladder to the supernumerary (ductal) gall bladder.

fluid. This experience was repeated the following night for two hours. Roentgenological investigation of the gall bladder failed to show any calculi. These attacks of pain accompanied with vomiting recurred at irregular intervals in undiminished severity.

After every meal for the past year she has complained of belching, sour eructations, epigastric distress, fullness, pyrosis and bloating. The roentgenographical studies now made of the gall bladder and ducts by the dye method revealed 2 calculi.

Physical examination: The physical examination showed a well-developed, well-nourished female. The only significant finding was a slight tenderness in the right upper quadrant.

Operative Findings. Through an upper right rectus incision the following findings were noted: A rudimentary, narrow gall-bladder, 4.8 cm. in length, lay deeply set in the gall-bladder fossa (Fig. 1). It had slightly thickened walls and contained a dark viscid bile, but no calculi.

The cystic duct, 2.4 cm. in length and 16 cm.

in diameter, opened into the common bile duct at a slight angle. About 1.2 cm. below its entrance was a sac, approximately 1.5 cm. in
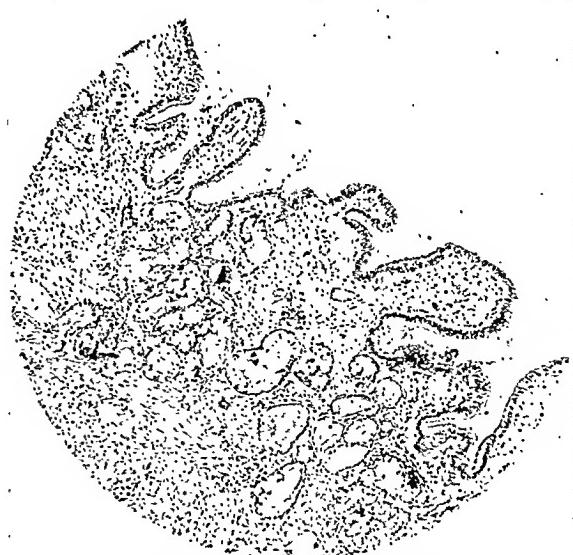
FIG. 2. Microscopic section of supernumerary gall bladder. The inner surface, the mucosa, is lined by columnar epithelium and assumes a papillary formation. Many of the tubular glands extend into the muscularis and serosa.

length and .8 cm. in diameter, arising from the common duct and lying close to the posterior

parietes, but distinctly free from the liver. The wall was surrounded by perisacular adhesions, from which it had to be dissected. Contained therein were 2 distinct rough calculi, yellowish brown in color, one of which was flush with the common bile duct (Fig. 1).

Cholecystectomy was performed with ligation of the cystic duct near the common bile duct. After incising the ductal sac and removing the calculi, the sac was cut away close to the common duct and drainage was established with a 16 F. catheter through the opening made by the removal of the sacular appendage.

Pathological Report. The specimen consisted of a sac 0.8 × 1.5 cm., its surface pink in color, smooth and glistening, with a small node 1 cm. from one end. On section the wall was found to be thick, the colorless mucoid secretion containing a small calculous deposit about 0.2 cm. in diameter.

The microscopical examination showed the specimen to consist of an outer thick serous membrane, covering a layer of smooth muscle arranged in irregular bundles. On the inner surface was a mucosa made up of papillae, lined throughout by columnar epithelium (Fig. 2). Many of the tubular glands extended into the muscularis and serosa. The small node was the seat of a diffuse endometrial hyperplasia of an inflammatory nature.

The patient made an uneventful recovery and was discharged sixteen days after operation. When recently seen, she had improved considerably in weight and was free from any digestive or upper abdominal distress.

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CASE REPORTS BY DR. STANLEY R. WOODRUFF*

NEW YORK

MULTIPLE CALCULI IN LEFT PELVIS OF HORSESHOE KIDNEY

THE patient, a female, aged thirty years, married, white, had suffered for the past five years with intermittent attacks of pain in the left flank, sometimes accompanied by chills and temperature. She had had long continued attacks of indigestion and malaise, and had reached the state of discouragement at which most chronic invalids usually arrive. The renal history had been varied. She had at times complained of frequency and some dysuria, and as a usual thing there had been little attention paid to the urine. She had had three abdominal sections for various preoperative diagnoses. Her appearance was that of a rather delicate, pale, undernourished woman. There was a slight systolic heart murmur. The lungs were normal; the abdomen was flaccid and revealed a mass in both the right and left umbilical regions, the one on the left side being larger. It was only slightly movable, and there was no complaint of tenderness. The urine had a specific gravity of 1012, was cloudy in appearance, and contained many pus cells and considerable albumin. The preliminary roentgenogram revealed several fairly distinct shadows grouped much lower and toward the midline than would be usually considered as being renal calculi. The kidneys were not definitely shown. By cystoscope the bladder was seen to be entirely normal. A renal functional test with indigo carmine showed an appearance time of ten minutes from the right ureteral orifice and fourteen minutes from the left, the quantitative output being practically equal from both sides and about 50 per cent of normal. Catheterized specimens from both sides showed a preponderance of pus from the left kidney. There was, however, considerable pyuria from the right side. Ureteropyelograms were made at separate sittings of both sides and the typical appearance of horseshoe kidney was demonstrated. The shadows observed in the preliminary exposure

* Read before Section of Genito-Urinary Surgery, New York Academy of Medicine, April 18, 1928.

ere noted to be covered by the contrast sub-
tance in the renal pelvis of the left kidney.
At operation the ureter on the left side was

the patient in order even to make an examina-
tion. At this time a hard, calcareous object was
made out both by palpation and instrumenta-

FIG. 1. Right side of horseshoe kidney.

FIG. 2. Left side of horseshoe kidney.

found to enter the renal pelvis at its upper
third, and most of the calculus deposit had
settled into its extreme lower end which had
become practically a cul-de-sac. A heminephrec-
tomy was hardly indicated here on account of
the poor function of the right portion, and a
plastic reimplantation of the ureter into the
lower portion of the left renal pelvis was
successfully accomplished.

RENAL, URETERAL, VESICAL AND IMPACTED URETHRAL CAL- CULI SIMULTANEOUSLY IN SAME PATIENT

THIS patient, a male, aged thirty-four
years, married, white, entered the hospi-
tal acutely ill, complaining of severe pain
in the penis, and great difficulty and pain in
attempting urination. He gave a history of
passing renal calculi on several occasions during
the last three years. His attack of pain at
this time came on three days ago, during
the act of micturition, and was accompanied by
sudden stoppage of the flow. Urination has been
increasingly painful and difficult up to admis-
sion, when it became necessary to anesthetize

FIG. 1. Pyelogram of case of renal, ureteral, vesical and impacted urethral calculi.

tion to be impacted in the urethra at about the
penoscrotal junction. After considerable diffi-
culty, this was removed and a catheter passed

into the bladder for drainage. The patient was then placed in bed and five days later roentgenogram was taken in order possibly to demonstrate more calculi. The resultant exposure justified the suspicion in that multiple calculi were demonstrated in the left kidney, the left lower ureter and bladder. A cystoscopic examination was then made which showed the bladder slightly congested, with tumefaction and edema at the left ureteral orifice. There were three small calculi in the vesical cavity.

A renal functional test gave a normal appearance time and normal quantitative output from the right ureteral orifice. There was no appearance from the left side after fifteen minutes' observation, and a small catheter passed to the left renal pelvis revealed no dye, the resultant secretion being a purulent fluid.

The necessity of nephrectomy, ureterotomy, and cystotomy was apparent, and was successfully performed with the removal of all calculi three days later.

CASE REPORTS BY DR. A. R. STEVENS*

NEW YORK

TRANSPLANTATION OF URETERS INTO THE BOWEL

IT has seemed to me worth while to show two cases of double implantation of ureters into the bowel, done by different methods, both because of incontinence but due to different underlying causes.

CASE I. A colored man, aged fifty years, gave a history of having had gonorrhoea several times. In 1914 he had a perineal incision for perineal abscess and stricture, and in 1923 an external urethrotomy and resection of perineal fistula. In July, 1926, he was admitted to Bellevue Hospital because of recurrent fistulae and partial incontinence of urine; in fact he was completely incontinent while standing but only partially while lying down. The Wassermann reaction was negative. His spinal fluid reaction was negative. Sounds up to 30°F. were easily passed to the bladder.

He was operated on in the hope first of cleaning up his perineum. Some of his fistulae were excised and the others opened up into one common perineal cavity. Incidentally, an abscess of the prostate was opened. His wound remained infected and on August 13, a suprapubic cystoscopy was done, in the hope of hastening the healing of the perineal wound by keeping it dry.

The writer first saw the case September 15, 1926. He had then a large perineal wound which was continuously wet, his urethra was open for 3 in., and 1½ in. of the urethra had entirely sloughed. An attempt at cystoscopy was made but the bladder would not hold any fluid. The patient was kept around the ward for a long time in the hope that by care and frequent cleansing we could heal the perineal wound and later make a plastic perineal repair of the sphincter and urethra. However, he did not seem to make any great headway, and the writer suggested to him that, inasmuch as he could not work and associate with his friends in his present condition, he have his ureters implanted in the lower bowel.

On December 17 we operated through a low left rectus incision, located his left ureter, exposed that from the promontory downward, freed the peritoneum, stitched it up behind the ureter, and implanted the latter in the sigmoid by the Coffey technique. No catheter was left in the ureter, but a tube was kept in the rectum for about four days. We were very much surprised that there was no kidney pain following this and no temperature above 100°F. Ten days afterward we injected indigo carmine intravenously and obtained a very marked color in the urine from the rectum.

On January 18, 1927, under spinal and general anesthesia, a mid-line incision was made, the right ureter was exposed from the promontory to the bladder. The bladder was incised and was found to be a real contracted bladder with a wall 1 cm. thick. A ring of bladder mucosa was cut away about the ureteral orifice

the bladder was sewed up and the right ureter implanted by the Coffey technique. A catheter was left in the ureter. In comparison with the operation on the other side, with no catheter in the ureter, there was some fever (up to 102°F.) and pain in the corresponding kidney. In both instances a cigarette drain was placed at the site of the ureterosigmoidal anastomosis.

About six weeks after this last operation the patient was able to hold the rectal contents for about four hours. When he went home on March 16, about two months after his last implantation, he was able to hold his urine from four to six hours. We did a phthalein test and obtained from the rectum 20 per cent in two hours. His blood chemistry was normal. His perineal wound has not yet closed up.

CASE II. The other patient was a case of ectopia vescicae. When the patient first came to the writer in the fall of 1911, he was a boy of sixteen. Three attempts had been made to close the bladder when he was about two years old. It is not necessary to go into the details of the history; they have already been published. We catheterized the ureter and proved that there was no infection of either kidney; the phthalein output was 30 per cent in one hour. Operation was performed April 6, 1911, by the Bergenhem method, that is, both ureters were isolated extraperitoneally from the promontory of the sacrum to the bladder and cut away with a small ring of bladder mucosa attached to each, without either ureteral orifice being cut into. These were implanted into his rectal wall through independent small holes and were left there without any suture. During convalescence there were attacks of pain in the left kidney, which clearly indicated some infection of that side. The patient went home from the hospital two months after his Bergenhem operation, able to hold his urine in the rectum for from two to six hours. For the first few months he had quite a bit of nocturnal incontinence but gradually gained complete control. He called on me last fall and at that time was quite able to hold it for from four to six hours and had measured individual voidings that were as much as 350 c.c. His phthalein output in two hours was 25 per cent. He has gone on now about seventeen years and is entirely comfortable and able to work and mingle with his friends.

LEUCOPLAKIA IN A BLADDER DIVERTICULUM

THERE are four interesting points in this case: (1) large chunks of epithelium were passed; (2) the patient had no urinary complaint; (3) he had leucoplakia in this diverticulum, and (4) there was a cystoscopic resemblance to carcinoma.

There had been only two cases of bladder diverticulum containing leucoplakia reported up to the time when Dr. Bughee reported one and the writer reported this at the recent meeting of the American Association of Genito-Urinary Surgeons. The first operation the writer performed on returning from this meeting was another diverticulum case which presented typical leucoplakia both grossly and microscopically.

The patient had a very marked urinary infection and complained of marked frequency of urination.

DERMOID CYST OF KIDNEY*

J. J. VALENTINE, M.D., F.A.C.S.

NEW YORK

ONLY a few cases of dermoid cyst of the kidney have been reported in the literature and their pathological study is scantily recorded. The most recent contribution seems to be by J. F. Baldwin of Columbus, Ohio in 1915. In his article he quotes the famous case of Sir James Paget[1] of dermoid tumor of the kidney in

*Read before Section of Genito-Urinary Surgery, New York Academy of Medicine, March 21, 1928.

the sheep, as well as five complete case reports in the human.

In order to analyze these cases and to compare the interesting findings with the one now presented, they may best be tabulated.

in the cysts five times. An indefinite substance of varying color and consistency occurred within the cysts in 6 cases. Cholesterin crystals were found in 4 cases; fat in 4 cases. Two of the cysts were subcapsular.

DERMOID CYSTS OF KIDNEY

Cases	Age	Sex	Palpable Tumor	Urinary Symptoms	Pain	Preoperative Diagnosis	Pathology and Contents of Cyst	Result
Haeckel's[3] reported by Wedeman.	58	F	Several yrs.	None	Yes	None made	Pultaceous yellow substance. Hair	Recovery
Goldsmith[4]	20	M	2 yrs.	Hematuria	Colic	Floating kidney with twisted pedicle	Subcapsular cyst. Large quantity reddish mealy material. Hair	Recovery
Walker[5]	11	F	1 yr.	Irritable bladder	Colic and pain in l. lumbar region	None made	Three cysts: one filled with fatty material and fine hair	Recovery
Schlegtendal & Madelung.[6]	22	M	All his life	None	None	Ecchinococcus cyst of liver	Cystic tumor filled with smeary mass. Fat cells. Crystals of cholesterin	Died
Boni[7]	45	F	10 yrs.	Not stated	Not stated	Hydronephrosis, probably due to calculus	Five intercommunicating cysts. Yellowish green turbid fluid and detritus. Skin structure with sebaceous sweat glands. Hair follicles and hair	Died
Wyss[8]	..	..					Ossified walls containing mass of cholesterin	
Bardenheuer[9]	..	..					Fat and hair	
Baldwin[10]	16	F	14 yrs.	None	None	Possible ovarian dermoid	Walls of bony plates. Cavities containing different colored fluids. Cholesterin crystals. No hair	Recovery
Author's Case	46	F	No	Yes	Yes	Probable renal calculus (cortical)	Subcapsular cyst. Thick light yellow pasty substance. Fat globules and cholesterin crystals. No hair	Recovery

It will be noted that a palpable tumor occurred in all but the present case, and that the tumor had been there for several years.

Probably because these cases presented themselves many years ago and because they were studied by other than urologists, no detailed urological investigation was made either by cystoscopy or roentgenology.

The pathological findings, while not alike in all the cases, bear some degree of uniformity. For example, hair was found

Attention is called to the fact that in no instance was it possible to make a correct preoperative diagnosis, as there seemed to be no definite characteristic clinical symptoms nor has there been a sufficient number of cases studied from the urological standpoint to submit additional valuable data.

CASE REPORT

Mrs. M. O., aged forty-six, admitted to Polyclinic Hospital June 23, 1927. Chief complaints were frequency and burning urination, pus in urine for many years and pain in back.

Her general history was negative except for her urological disturbances. For many years she had had marked frequency of urination

project into the urethra anterior to the sphincter. These bodies as well as the larger tumor were destroyed by fulguration with the electro-

FIG. 1. Showing shadow in left kidney resembling calculus.

FIG. 2. Pyelogram showing shadow within kidney.

with considerable burning which occurred during and after the act. At times she had seen a little blood in her urine. She also stated that she had had a left-sided backache for several years.

General examination negative as regards chest and abdomen. Because of her marked frequency and burning urination, our attention was first fixed on her bladder and urethra. Voided urine was hazy, containing a moderate amount of pus, a few red blood corpuscles, and culture showed a gram-negative bacillus growth.

Cystoscopy showed bladder congested, otherwise negative. Not finding sufficient pathology

tome current. Following this there was very little reaction. The patient remained in the hospital about forty-eight hours and was allowed to go home.

She reported to the Clinic in two weeks and stated that her frequency of urination was materially reduced and that she felt very much better. She had less burning than she had experienced in years. Her backache, however, was not in any way relieved. A plain roentgenogram was taken and cystoscopy performed at this time to investigate her upper urinary tract.

Both ureters were catheterized and specimens obtained. Examination of these specimens showed:

	Left	Right
Gross appearance of urine	Clear (later bloody probably trauma)	Clear
Urea	0 4 per cent	0 9 per cent
Blood	5–10 per field	10–15 per field
Epithelium	Rare cell	Occasional
Leucocytes	About 2 per field	1–2 per field
Culture	Sterile	Sterile
Indigo-carmine	4 min in good concentration	4 min. in good concentration

in the bladder, urethroscopy was performed and a small cystic tumor was seen in the midline on the upper margin of the bladder neck. Also several small cystic bodies were seen to

Blood chemistry, normal.

Despite the lack of pathology in urine, the roentgenographic findings, with and without pyelograms, made us conclude that we were

dealing with a cortical stone in her left kidney, and exploration was advised.

Operation. A left curved, oblique, lumbar incision was made, exposing a normal sized kidney. Before freeing kidney to bring it up into the wound, careful palpation was made for the calculus but it was not felt. The kidney was then freed and brought up into full view in the wound. Inspection showed the true capsule of the kidney to be separated from the kidney itself by fluid under the capsule. Several bubbles could be seen under the capsule and made to move by making pressure on the kidney. At about the juncture of the upper and middle portions of the kidney, in the central line along the cortex, could be seen a yellowish mass, plainly visible through the true capsule and not attached to it. The true capsule was nicked and about 2 drams of fluid escaped. The true capsule was separated for the entire length of the kidney and was readily peeled away, exposing the growth just mentioned. This growth, as one looked down on it, appeared larger than the diameter of a twenty-five cent piece, and looked something like an old tuberculous (firm, cheesy) deposit. It seemed to be covered by its own capsule, and it was easily separated from the adjacent cortex of the kidney. It was not attached to the true cortex in any portion except at its very base where it seemed adherent. When enucleated from its bed the point of attachment bled freely. This point of bleeding was clamped and ligated. The bed of this growth now seemingly was a gap in the kidney, lined with true kidney cortex. The capsule was then sutured with plain catgut and the cavity from which the growth was removed was packed

FIG. 3. Schematic drawing showing subcapsular location of cyst and its relation to calcies.

with iodoform gauze, the end of which was used as a drain extending from the upper angle of the wound, and the kidney was dropped

FIG. 4. Dermoid cyst after its enucleation from kidney.

back into its natural bed. The wound was closed in the usual layer fashion.

Postoperative recovery was uneventful and the patient left the hospital twenty-six days later.

Pathological Report. The specimen was composed of a cystic structure removed from the kidney. It was circumscribed, ovoid in shape, and measured $3\frac{1}{2} \times 2\frac{1}{2} \times 1$ cm. It contained a thick, light yellow, pasty material.

Microscopical examination of this material showed numerous fat globules and a few cholesterin crystals. The wall varied from 1 to 3 mm. in thickness and the inner surface was roughened. There was apparently no lining.

Microscopical examination of sections taken from different areas of this wall showed that it was composed chiefly of dense strands of hyaline connective tissue. On the inner surface there was a loose areolar structure in which there were many blood vessels, some of which had rather thin walls but others had very much thickened walls. It was also infiltrated with numerous inflammatory cells. There was no lining epithelium observed. Diagnosis was dermoid cyst of the kidney.

Postoperative history. Patient has been seen frequently since the operation, and she states that she has completely recovered from her urinary frequency as well as from her backache.

The case in question is interesting primarily because of the early and accidental

discovery of the cyst in the course of ordinary routine urological examination. The cyst, casting a roentgenographic shadow which was interpreted as being a calculus, was sufficient reason for operative interference for the relief of pain. It is likewise of interest to have learned that the cyst was subcapsular, causing an exudate to distend the true capsule of the kidney, producing nephralgia. After removal of the cyst the pain ceased.

J. R. Losee, who studied this specimen, refers us to Ewing's[10] work wherein is recorded: "Epidermal rests derived from the Wolffian duct are probably the source of certain dermoids of the kidney. They contain no dermal glands."

Rokitansky[11] says there is often no epithelium in the larger cysts and their inner layer is striate blastema externally spreading into fibers in the direction of the long axis of the oval nuclei it contains.

Losee states that regardless of the fact that no squamous epithelial lining was observed in this cyst, he believes the diagnosis can be made from its contents.

It is understood that these cysts arise from remnants of the mesonephros, which structure is supposed to degenerate in the latter stage of the development of the embryo. If part of this does not degenerate there is some form of cystic structure remaining. The epithelia, lining these mesonephric tubules, are not very well differentiated at that early period, therefore one can conceive that it would be possible to have any one of these various types of epithelia.

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CASE REPORTS BY DR. ARTHUR M. DICKINSON*

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BILATERAL SNAPPING HIP

SNAPPING of the hip may not be an unusual condition in large orthopedic centers, but to the general surgeon it is a very uncommon and often trying condition. References to it in the literature of this country are rather meager as contrasted with the quite frequent cases reported in foreign literature.

A certain amount of snapping of the hip may be almost physiological in children and also in adults with relaxed periarticular structures. In some instances it becomes a practiced trick to be demonstrated at will for the astonishment of companions. As a rule this type of snapping hip does not cause pain and discomfort. When pain and discomfort do result, the condition becomes pathological. Commonly only one hip is affected.

ETIOLOGY

There are many factors which have been considered as causes in producing snapping of the hip. A few of these are inflamed bursae, malformations of the hip joint, a tic or spasm of the muscles, either voluntary or involuntary, and muscular relaxation, especially of the gluteus maximus, with or without actual tears in the muscle.

Before the causal factors are weighed, it is well to consider the anatomy of the parts. The hip joint is essentially a ball and socket

joint, the head of the femur being received in the acetabulum. Both head and acetabulum are covered with cartilage. The cartilage of the acetabulum is horseshoe shaped, being deficient below. The ligaments of the joint are the capsular, the iliofemoral, the teres, cotyloid and transverse. Many bursae of varying sizes exist about the joint, some anatomists having described twenty-one. The bursae that are of practical interest to us at this time are those located in the neighborhood of the greater tuberosity. There are several of these. One is located between the greater tuberosity and the gluteus maximus, another between the tuberosity and the skin, two between the tuberosity and the gluteus medius, and another between the tuberosity and the gluteus minimus. The muscles and fascia most concerned in snapping hip are the glutei maximus and medius and the iliotibial band. The gluteus maximus is the very fleshy, strong muscle which forms the prominence of the buttocks. It arises from the ilium and sacrum and, passing obliquely down and outward, is inserted by a thick tendon which runs across the greater trochanter into the fascia lata covering the outer side of the thigh. Some of the deeper fibers are inserted below the greater trochanter. The gluteus medius arises from the ilium and is inserted into the oblique line which traverses the outer surface of the greater trochanter. The iliotibial band is that thickened portion of the blended layers of the fascia lata which continues down the thigh to be inserted into the external tuberosity of the tibia. The greater trochanter is a large irregular bony eminence situated at the outer side of the neck of the femur. It is directed outward and backward. The gluteus medius tendon is attached to its external surface and the tendon of the gluteus maximus plays below and behind.

It will be seen from this brief review of of the anatomy that snapping of the hip must arise either in the hip joint or in connection with the bursae and muscles and the greater tuberosity. In all reported cases of true snapping hip in which roentgenographic studies of the hip joint have been made, the bony parts have been found normal. It is difficult for one with any semblance of mechanical understanding to conceive how an enlarged or inflamed bursa could be the cause of snapping of the hip. In examining the patient with a snapping hip, one is at once struck with the impression that the snap occurs in the neighborhood of the greater trochanter. It seems as if there was a tight band which snapped across the trochanter when the thigh was rotated. The two structures which could possibly cause this are the gluteus maximus and the iliotibial band. The majority of writers consider the latter as the chief offender.

Binne[1] in 1913 reported 2 cases, in 1 of which there was found a sausage-shaped thickening of the fascia lata and in the other the snapping part was the anterior border of the gluteus maximus. Mayer[2] in 1919 reported 4 cases. In case 1 he stated there was a snap audible to the distance of 20 to 30 feet. It was successfully treated by adhesive plaster strapping with a pad behind the trochanter. Cases II and III were treated by a special pelvic girdle. Case III was due to previous removal of a strip of fascia lata by himself. Case IV was operated upon; no thickening was found in muscle or fascia. The edges of the fascia were sutured to the periosteum of the greater trochanter and a cast applied. Mayer places great stress upon the thickening of the portion of the fascia lata which Zur Verth called the tractus cristofemoralis. Mayer feels that the snap is the result of this band catching behind the trochanter and that the band jumps when the strain becomes too great. He is apparently of the opinion that the condition is solely the result of fascial changes. He concludes that a relaxation of the gluteus maximus is a necessary factor in the causal mechanism.

Jones[3] in 1920 cited 2 cases in both of which the snapping was due to the tendon

of the gluteus maximus. He found that the snapping occurred only when the tendon was tense. He noted that the snap disappeared when the patient was relaxed by an anesthetic. Pruitt[4] in 1920, reporting on this subject, stated that all cases were due to some abnormality of the fascia lata or the greater trochanter whereby the fascia was caught behind the trochanter. He considered as the etiological factors the thickening of the tractus cristofemoralis and unusual prominence of the greater trochanter. Fairbank[5] in 1921 reported briefly a case of bilateral snapping hip complicated with other orthopedic conditions. Lovett[6] states that the condition is one of no great rarity and that the common cause is a slipping of a tendinous band (usually the iliotibial) over the greater trochanter. DaCosta[7] says that it is due to a slipping of a fibrous band (iliotibial) over the greater trochanter. Whitman[8] considers that the snap is due to friction between the tendon of the gluteus maximus and the greater trochanter. The weight of evidence seems to favor the iliotibial band and the gluteus maximus as the causative factors. Whether the condition is congenital or whether it is developmental or traumatic cannot be stated with assurance. However, it could be explained on the basis of a congenital defect more easily than by other means.

SYMPTOMS AND PHYSICAL FINDINGS

Patients with this condition commonly report that they have a snapping hip. The diagnosis simply requires confirmation. While snapping hip may not be a disabling condition it is uncomfortable for the patient. Some patients state that the snapping causes a sick feeling in the stomach; others tell you that there is simply a feeling of weakness in the affected hip. With a few individuals, particularly children, it is simply a trick performed at will and causes no symptoms.

The snap can always be felt by the observer; frequently a bulging of tissue may be seen at the time of the snap and in rare instances the snap is definitely audible. Upon palpation, one can feel the band snap as the leg is moved. A very satisfactory manner of feeling the snap is to walk behind the patient as he walks along, keeping a hand over each hip. If the patient reclines on the examining table, external rotation of the thigh with partial flexion of the leg will usually bring out the snap. By placing one hand on the hip and rotating the thigh with the other hand placed on the knee, the snap can be demonstrated. In some instances the snap is so severe that a roll of tissue may actually be seen jumping over the trochanter as the snap occurs. Mayer[2] cites a case in which the snap was audible to a distance of 20 to 30 feet. Frequently we are just able to hear the snap in a quiet room when in close proximity to the patient.

In every case of suspected snapping hip, roentgenograms of the pelvis and hips should be made to rule out changes in the bony skeleton.

TREATMENT

Non-operative treatment has been successful in some of the reported cases of snapping hip. Mayer[2] reported one case treated satisfactorily with adhesive plaster straps and pads placed behind the trochanters. He also reported the successful use of a pelvic girdle in these cases. In the majority of instances however, non-operative treatment has not been a success.

Obviously the object of operation in these cases is to relieve the cause of the snapping. To do this, it is necessary to actually see the band, which is at fault, snap over the trochanter. As the snap is frequently absent under the relaxation due to general anesthesia, operation should be performed under local anesthesia. Various types of operative procedures have been used, depending on what is found at operation. Binne[1] treated his case with a sausage-shaped thickening of the fascia lata by raising the periosteum below the greater trochanter and suturing the posterior edge of the incised fascia lata to this.

The anterior edge was then sutured over. Mayer[2] treated one case by suture of the cut edges of the fascia lata to the greater trochanter. Lovett[6] mentions several procedures which have given relief: suture of the obstructing band to the tendinous insertion of the vastus externus and the neighboring periosteum, uniting the iliotibial band to the femur behind the trochanter, or sewing the posterior edge of the band to the gluteus maximus. Pruitt[4] recommends simple division of the snapping band.

Judging from reported cases, the more complicated procedures mentioned are no more successful than simple division of the band. Furthermore, immobilization of the limb should not be resorted to after operation as was formerly the custom. Walking should be encouraged within a few days after operation. Briefly, then, the successful treatment of snapping hip requires but simple division of the obstructing band under local anesthesia.

CASE REPORT

W. P., male, aged nineteen, entered Memorial Hospital on January 11, 1927, complaining of snapping of the right hip. He had been injured three months previously when he fell several feet, landing on his back. The fall did not incapacitate him, but about three weeks later his right hip commenced to snap. For this condition he had been operated upon on November 26, 1926, but the result was unsatisfactory.

When first seen by the author there was definite snapping of the right hip. The scar of previous operation was well healed. A mass of tissue could be seen to jump forward over the greater trochanter as the patient walked. It could be palpated very plainly but there was no audible snap. With the patient reclining on the examining table, the snap could be produced by partial flexion and external rotation of the thigh. The constant repetition of the snapping made the patient feel sick at the stomach. Roentgenograms of the pelvis and hips were negative for any bony changes. The general physical examination and laboratory findings were negative.

On January 12, 1927, operation was performed under ether anesthesia. Due to the formation of scar tissue from the previous operation, anatomical details were somewhat distorted. An incision 5 in. long and parallel to the long axis of the thigh was made with its center over the greater trochanter. The iliotibial band seemed to be abnormally thickened and tense, so this was divided transversely. The cut edges of the fascia lata were then sutured to the greater trochanter. The wound was closed and a plaster spica applied. The cast was left on for three weeks and when it was removed, no snap could be produced in the right hip. A few days later the patient began to complain of snapping of the left hip. On February 16th the left hip was operated upon under ether and a condition similar to that on the right side was found with the exception that there was no scar from a previous operation. The treatment was the same: section of the iliotibial band with suture of the fascia lata to the greater tuberosity and application of a plaster cast. The cast was removed after three weeks and no snap could be elicited in this hip. The patient was discharged on March 17, at which time the right hip was noted to snap occasionally but not seriously.

On April 6 the patient was readmitted because of a return of the snapping of the right hip. The intensity and frequency of the snap had been increasing since discharge from the hospital until it was now as great as before operation. On April 7 the right side was again operated upon, this being the third operation on that side. This time operation was performed under local anesthesia (infiltration with $\frac{1}{2}$ per cent novocaine), for at the previous operations performed under general anesthesia we were unable to elicit the snap on the operating table and so actually were unable to visualize the structures at fault. At operation the anterior border of the gluteus maximus was seen to be the offending structure. This was divided transversely for a distance of $1\frac{1}{2}$ in., which eliminated the snap. The wound was closed but no plaster was applied. The patient was out of bed on the fourth day and on the seventh was walking without any snap; he was then discharged.

On June 7 he returned to hospital because of a reappearance of the snapping of the left hip. Operation was performed under local anesthesia on June 8. At operation the fascia lata seemed like a tight band which snapped across the trochanter. The fascia lata and the anterior edge of the gluteus maximus were both divided

transversely for a distance of 1½ inches, which relieved the tension and eliminated the snap. No plaster cast was applied. The patient was out of bed on the sixth and home on the ninth postoperative day. At the time of discharge from the hospital, there was no snap in either hip. One month later the case was followed up and neither hip snapped. Six months after the final operation he was again examined. At this time, there was a very rare and slight snap in the left hip region. This was not disabling so further operative treatment was not advised.

CONCLUSIONS

1. True snapping hip is a relatively unusual condition; bilateral snapping hip is rare.

2. The factors at fault may be a thickening of the iliotibial band or the gluteus maximus.

3. Operations for relief of this condition should be performed under local anesthesia. Early mobilization of the joint is essential.

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TYPHOID FEVER GALLSTONES*

THE relation between typhoid fever and gallstones is of more than clinical interest; it is of definite importance in the spread of typhoid fever.

We know that typhoid bacilli are eliminated from the body of a typhoid patient through the urine and feces. The Bacillus typhosus has been recovered with such constancy from the gall bladder on autopsy of patients dying of typhoid fever

*Read before the Albany County Medical Society, February 8, 1928.

and from bile removed by duodenal drainage from living patients, that there is little doubt that the organism finds its way into the biliary passages in nearly all cases of typhoid fever and develops there. About 10 per cent of persons recovering from typhoid fever become carriers. The chronic carrier usually harbors the organisms in the gall bladder from which they are eliminated by way of the intestinal tract.

In view of the knowledge that typhoid bacilli so commonly lodge at least temporarily in the gall bladder, the theory might be advanced that the organism was the sole cause of gall-bladder disease in many instances. There are other factors, however. From a bacteriological study of the bile of cases coming to operation for gall-bladder disease, it has been found that 11 per cent are of typhoid origin while the cultures were sterile in 52 per cent. Typhoid organisms are found in the centre of gallstones quite often. The incidence of gallstones is variously given. They are found in about 6½ per cent of all persons coming to autopsy; they have been noted in about 12½ per cent of all persons coming to operation for some abdominal condition other than gall-bladder disease. Infection is recognized as the most important factor in causing gallstones and, of the organisms found, the typhoid bacillus heads the list.

An attack of typhoid fever may result in later gall-bladder diseases with possible stone formation. Also we see that the biliary tract harbors organisms for long periods of time after an attack of typhoid fever and that these so-called carriers may be a source of danger to others.

CASE REPORT

Mrs. M. S., aged forty-six, first seen January 9, 1928, at her home, complained of pain in the upper abdomen and vomiting. She stated that she had been taken two days previously with pain in the upper abdomen which felt like a tight cord just under the free margin of the ribs. The pain was not colicky. Following the onset of pain she vomited. The pain continued but she did not vomit again. At the time of

examination, the patient had a temperature of 101°, a pulse of 92 and a respiratory rate of 24. There were a few moist râles at both bases posteriorly. There were moderate tenderness over the gall-bladder region and slight spasm of the right rectus. The patient stated that she had had similar attacks frequently in her early years but for the twenty years preceding 1926 she had been free from them. In 1926 she suffered a very severe similar attack. In 1914 she had typhoid fever and was moderately ill.

The next day the patient was admitted to the hospital. Upon admission, the temperature was 105°, pulse 120, respirations 28. Slight jaundice was noted. The chest still showed a few râles. The abdominal signs were essentially as before. The white blood count was 10,120. The urine showed sugar and albumin, acetone and diacetic acid. The blood pressure was 130–80. The patient looked sick and was sick. Digitalis was started and glucose solution given by rectum.

On the day following the patient was improved. The maximum temperature was 101.8°, pulse 94, respirations 22. Jaundice appeared about the same. The blood pressure was 110–66. There was no change in the chest findings. There was a definitely palpable mass in the gall-bladder region with moderate tenderness. The white count was 10,600; the urine showed a trace of sugar, a positive acetone and a negative diacetic reaction. The blood sugar was 150 mg. Widal's reaction was positive.

On the next day the patient was much improved. The highest temperature recorded was 100.2°. There was less icterus. The chest was negative. The abdominal signs remained unchanged. The Widal reaction was positive. The urine showed traces of sugar, acetone and diacetic acid. The Vandenburgh test showed an immediate positive reaction.

On the following day there was no visible jaundice. The temperature remained normal and the patient felt good. There were no signs in the chest. The abdomen showed a definite, tender mass in the gall-bladder region. The blood pressure was 132–78. The urine showed a faint trace of acetone and much bile. The coagulation time of the blood was two and one-half minutes.

On the next day the patient was operated upon and the gall bladder and appendix removed. The patient stood the operation well. A rubber tube was tied to the stump of the cystic duct to take care of any leakage. The gall bladder was transferred to the laboratory under aseptic condition where cultures made from the bile showed bacillus typhosus. The gall bladder was filled with stones. The laboratory report was chronic cholecystitis with cholelithiasis and chronic appendicitis.

The day after operation the patient was in good condition. She tolerated liquids. The urine was negative except for a trace of acetone. Two days after operation, a small amount of bile came out through the drainage tube. This continued for several days, presumably from the raw surface of the liver which I had been unable to peritonize satisfactorily. The tube came out on the seventh day after operation and the wound promptly healed. The Widal reaction at this time was positive. The patient made an uneventful surgical recovery but on January 23, nine days after operation, she showed a stool for positive typhoid organisms after previous ones had been negative. However, on January 28, 29 and 31, we obtained negative stools. The patient was discharged on February 4 in good condition.

This case presented several problems. When I first saw the patient, in spite of her history I was suspicious of a central pneumonia with referred abdominal symptoms. When the patient's temperature rose to 105°, I felt more inclined toward a pneumonia, for certainly gall-bladder cases rarely do this. With the urine report showing sugar and albumin, acetone and diacetic acid, I was further confused. Of course the persistant low white cell count was against a pneumonia. With the appearance of a palpable mass and clinical jaundice I felt more certain of the diagnosis. The changes in the urine are illustrative of the disordered chemistry of the body brought about by vomiting, limited fluid intake and pancreatic disturbance. The Widal test taken on speculation remained positive throughout, apparently due to her old typhoid condition.

In view of the fact that this patient had gallstone attacks before the typhoid fever, one cannot attribute the gallstone formation to the entrance of the typhoid bacilli into the biliary tract. Unfortunately no stool examinations were made before operation. They would undoubtedly have shown

typhoid organisms just as they did post-operatively. The typhoid bacilli had apparently been lodged in the biliary tract since the patient had typhoid fever. This made her a chronic carrier and it seems likely that she was responsible for new cases every now and then. Thus by surgical means she was relieved of a condition uncomfortable to herself and probably a menace to others.

BILATERAL ANEURYSM OF THE RENAL ARTERY*

WILLIAM JAMES CARSON, M.D.

MILWAUKEE

DANIEL NEBEL[1] in 1717 first described aneurysm of the renal artery. Keen[2] in 1900 collected 12 cases from the literature and reported a case in which he performed a right nephrectomy. Orth[3] in 1919 was able to collect 31 cases from the literature and reported 1 of his own. Since the appearance of Orth's article, 16 cases have been reported by Vogeler[4] (not confirmed by operation or autopsy), Conroy,[5] Roth,[6] Rowlands,[7] Schramm,[8] Richardson,[9] Soderlund,[10] Healey,[11] Chisholm,[12] Renck,[13] (2 cases), Callahan and Schiltz,[14] Dorndorf,[15] Meyer and Singer,[16] Weiss,[17] and Singer,[18] to which may be added 1 case described below, bringing the total to 49.

CASE REPORT

F. V., white, male, aged sixty-two, was first seen on October 6, 1925, in the dispensary, complaining of frequency of urination (hourly during day, night, two to three) hematuria, and painful nodules over the abdomen and back which had been present for years. A diagnosis of carcinoma of the bladder, adenoma of the prostate (cystoscopic) and von Recklinghausen's disease was made. As the patient refused hospitalization, deep roentgen ray treatment, one and one-half hours each day for four days, was given. On November 6, 1925, he was admitted to the University of Maryland Hospital, complaining of severe pain over the bladder and profuse hematuria. He died November 7, 1925.

Laboratory findings: November 6. Urine: sp. gr. 1.012, albumen 2 +, sugar negative, large number of W.B.C. and R.B.C. Blood: R.B.C. 3,800,000; W.B.C. 13,200; hemoglobin 60 per cent, blood chemistry: N.P.N. 0.37 mg., sugar 0.118 mg. per 100 c.c. blood. Wassermann reaction negative.

Anatomical diagnosis: carcinoma of the bladder involving the base and lateral wall, obstructing the right ureteral orifice; metastases to the lymph nodes along the internal iliac arteries, abdominal aorta, and spleen; hydroureter, right; hydronephrosis, right; ureteritis, bilateral; adenoma of prostate, all lobes; aneurysm of renal artery, bilateral; von Recklinghausen's disease; solitary cyst, left kidney, upper pole;[19] two large cysts on anterior surface of right kidney.

Right renal artery divides into three branches at a point 3 cm. from the aorta. On the anterior surface of the artery, proximal to its division into branches, a definite dilatation measuring 10 by 14 mm. is seen. This dilatation is a sacular aneurysm, its wall measuring 2 mm. in thickness. The diameter of the aneurysm is 14 mm. The intima is smooth and glistening and in direct continuity with that of the artery.

Left renal artery divides into three branches 3.5 cm. from the aorta. Between the bifurcation of the superior and middle branches a dilatation measuring 8 by 6 mm. is seen. On section this is seen to be a definite aneurysmal sac. The wall is in direct continuity with that of the artery.

Microscopical Examination. Sections taken from proximal part of renal arteries show moderate thickening of the tunica intima, with the elastic lamina well preserved. Sections through the sac show the wall to be composed

of fibrous connective tissue for the most part, with areas stained as a pale pink homogenous mass. Few muscle fibers are seen, and no elastic
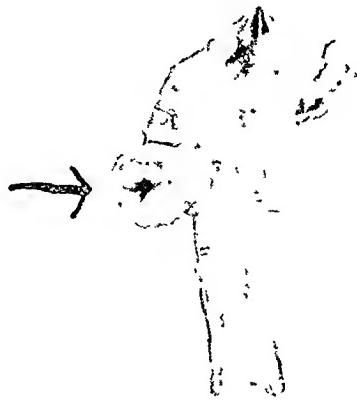
FIG. 1. Right renal artery showing sacular aneurysm 14 mm. in diameter.

lamina can be made out. The intima is poorly stained.

INCIDENCE

The incidence of this condition is very small as shown by Mueller.[20] In a study of 6425 autopsies he found 171 aneurysms of which only 3 were located in the renal artery. Bosdorff[21] found 93 aneurysms in 3108 sections, not one of them being renal. Emmerich[22] found 1 renal aneurysm in 7669 autopsies. In a recent study of the renal blood vessels in 400 bodies no other case was encountered.

Age Incidence. In the cases of traumatic origin, this varies from fifteen to fifty-six years; average, thirty-six. In the spontaneous cases the ages vary from nine to eighty-two years with a general average of fifty-six. The average age incidence for all cases of both types in which an age was given is forty-six years.

ETIOLOGY

In the etiology of renal aneurysm, trauma is of first importance. Conroy found 17 cases due to trauma, 6 cases associated with generalized arteriosclerosis, and 9 cases occurring in patients who had had severe infections.

TYPES

All aneurysms have walls continuous with the walls of the blood vessel. The

FIG. 2. Left renal artery showing aneurysm between the bifurcation of the superior and middle branches.

literature on renal aneurysm contains 18 cases classified as "false" representing retroperitoneal, perirenal or the accumulation of blood or blood clots, which are the result of leakage from the renal vessel. They are usually located at the bifurcation of the renal artery or on its various branches, varying in size from 4 mm. to 5 cm. in diameter.

SYMPTOMS

The combination of abdominal pain, followed within a short period of time by the passage of bloody urine, is the most characteristic feature about the onset of the illness. In the majority of cases it is associated with trauma. A stitch-like pain over the kidney, which occurs in infarcts of the kidney, was described by Weiss. Hematuria was profuse enough to exsanguinate the patient in all instances, and intermittent hematuria has been reported in 9 cases. Dysuria may result from blood-clot filling the urethral orifice.

PROGNOSIS

Renal aneurysm which produces symptoms, is fatal in 100 per cent of cases where there is no surgical intervention. Usually there are severe attacks of pain and hematuria over a period of weeks or

months, and death results from hemor-
rhage into the renal pelvis, retroperitoneal
tissue, or peritoneal cavity. The longest
interval of time between onset of symptoms
and death was five years (Morris.[23])

In the 15 operations performed, up to
the present time 13 patients have been
cured and 2 have died. Nephrectomies
were done in 13 cases.

Orth was able to turn out the clots
and successfully suture the tear. Callahan
excised the sac and preserved the artery.
Orth reported good function one year
later and Callahan six months after
operation.

TREATMENT

For those cases which give rise to symp-
toms removal of the sac together with the
kidney is the best procedure.

CONCLUSIONS

Aneurysm of the renal artery is rare.
The cause of the condition can be divided
into (1) traumatic, (2) primary disease of
the arterial wall, either degenerative or
inflammatory and (3) secondary disease
due to extravascular morbid processes.

The forty-ninth case of true aneurysm
of the renal artery is reported.

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⟪ E D I T O R I A L ⟫

LOCAL TRAUMA AS A CAUSATIVE FACTOR IN CANCER

THAT a single local injury is not infrequently the direct or exciting cause of malignant tumors of nearly all types, has been very generally believed by medical men who have had a large clinical experience with cancer. This view is even more deeply rooted among the laity by whom it has been held for many centuries. It has been frequently disputed, however, by high authorities, chiefly pathologists who, in spite of their great knowledge of the histology and pathology of tumors, rarely have the opportunity of studying the disease in the living human being and still more rarely see it in its early beginnings. On the other hand the clinician, the man who is first consulted in a case of malignant tumor and who at once obtains a careful history of the case, should be more capable of giving a judicial opinion as to the value of the evidence bearing upon the question of trauma. With so many high authorities on record as doubting or denying the possibility of a local injury producing a malignant tumor,

the clinician has often hesitated to express his own opinion to the contrary, convinced though he may be of its truth. During recent years, with greater care in the recording of clinical histories, one cannot fail to be impressed by the large and increasing proportion of cases of both sarcoma and carcinoma in which there is definite evidence of a local injury occurring a few weeks or months prior to the appearance of the tumor. While many pathologists and some clinicians still refuse to accept the seemingly convincing evidence of a causal relationship simply because they can find no scientific explanation of it, the workmen's compensation commissions and higher courts both here and in Europe have ruled that local injury may be a competent exciting cause of cancer. In rendering such decisions they have brought to bear upon the question the same logic and common sense that have enabled them to settle other complicated and difficult problems that have come before them. Nowhere is this shown more clearly than in

a recent decision of the Supreme Court of Appeals of Virginia, quoted by Stephens in THE AMERICAN JOURNAL OF SURGERY for October, 1928:

The Supreme Court of Appeals of Virginia, in affirming an award of compensation under the workmen's compensation act for the death of an employee from sarcoma after an injury to his right side, says that whatever view the court might take of the medical opinions, they were frankly and at best but theories . . .

To this the court may add that the courts have in general found no difficulty, in cases similar to this one, in applying the ordinary rules of evidence, and in drawing the ordinary conclusions of cause and effect from established facts, and this court finds none. This, the court doubts not, courts will continue to do with a full sense of justification and without apology until the cause of cancer is definitely and scientifically established.

In the last two issues of THE AMERICAN JOURNAL OF SURGERY there have appeared two papers bearing upon this subject. In the first, "Bone Sarcoma," by Stephens[1] the writer attempts to show that local trauma as an exciting cause of cancer has but little evidence to support it. In the second paper, "Trauma, Carcinoma and Workmen's Compensation"[2] the author, Wainwright, contends that abundant proof has already been offered to show that local trauma may be unquestionably the exciting cause of the development of carcinoma. These two papers well illustrate the widely divergent opinions which are held at present among the profession at large. The reason for this great difference of opinion, we believe, is, that few of the average surgeons or physicians find time to make a study of the question from first hand data. They get their opinions from other and often early writers and, if their own experience does not support the view expressed, they lack the courage to dispute it.

Stephens, in his paper already referred to, states: "Our literature is filled with reports of clinical and pathological investi-

gations dealing with the question: Lowenthal in 1875; Gross in 1897; Coley in 1898." Every one of these authors upholds the view that antecedent local trauma is a competent producing cause of both sarcoma and carcinoma. One cannot help but ask the question why Stephens did not quote the later statistics of the authors already mentioned, which would either offer further support of the theory or discredit it entirely. My first paper on the subject published in 1898 was based upon a study of 170 cases of sarcoma in which a history of antecedent trauma was noted in 46 cases or 27 per cent.[1] At the time of writing my opinion was entirely unbiased, but since the publication of that paper I became deeply impressed with the large number of cases of sarcoma giving a definite history of local trauma at the site where the tumor later developed, so that thereafter, in every case of malignant tumor, I made a special effort to inquire most carefully into the early history as regards the presence or absence of antecedent local injury, and if present, to ascertain the exact nature and severity of the injury. My later experience based upon a far more comprehensive study of the question entirely confirms my earlier conclusions and the evidence now accumulated is so strong that I no longer have the slightest doubt that both sarcoma and carcinoma may be caused by a single local trauma.

In my paper on "Injury as a Causative Factor in Cancer[2] I stated:

The question of the causal relationship between trauma and cancer should be determined by a careful scientific and judicial study of all the facts bearing on such relationship. That is a question entirely independent of our ability or inability to offer a satisfactory explanation as to the nature of such relationship.

Both Phelps and Segond make too great an effort to discredit the direct statements of intelligent patients. When a woman of more than ordinary intelligence strikes her breast

[1] Stephens, Philip. 5: 364, 1928.
[2] Wainwright, J. M. 5: 433, 1928.

[1] Ann. Surg., March, 1898.
[2] Ann. Surg., 53: 1911.

against a sharp corner of a bureau, causing the characteristic signs of a local contusion (ecchymosis and tenderness); when a careful examination of the place immediately after the injury fails to reveal the presence of any tumor, but one or two or three weeks, or a month later, a hard tumor develops at exactly the point of injury, the supposed causal relationship may, with Phelps, be attributed to the "unreliability of patients' logical processes, which have hypnotized the attending physician into accepting the improbable assertions as undoubted facts." But when, in the case of a fractured humerus in a man in perfect health, we have an x-ray photograph taken immediately after the fracture, as in my case, showing absolutely normal bone structure and a few weeks later another photograph shows a typical sarcomatous tumor developing at the exact site of the fracture, and when subsequent operation with microscopic examination prove the correctness of the diagnosis; and again, when a surgeon makes an incision in the inguinal region for the operation for inguinal hernia, through absolutely normal structures, and four weeks later there develops at the exact site of the incision, involving all the layers of the scar, a rapidly growing round-cell sarcoma[1]—we have facts which in no way depend upon the logical or illogical processes of patients, and the explanation of which demands something better and more profound.

Stephens quotes Bloodgood as saying that in 1000 bone tumors of which about 400 were sarcoma he saw only 2 cases in which a roentgenogram was taken directly after the injury. While we in no way admit that it is necessary to have a roentgenogram taken immediately after the injury to prove that a sarcoma developing some two months subsequently was not already present at the time of the injury, my own statistics furnish a considerable number of cases in which such roentgen-ray examination was made and found entirely negative. I can recall 6 cases in which the roentgenogram proved negative and yet

[1] In this patient there was a primary but hitherto undiscovered sarcoma of the jaw and the local trauma incident to the hernia operation, by lowering the resistance of the tissues, produced a favorable nidus for the causative agent, be it sarcoma cell or some microorganism, to obtain a foothold and develop.

within a few weeks or months a highly malignant tumor developed at the exact site of the injury. In our opinion, the following case without an immediate roentgenogram is quite as conclusive evidence:

W. B., male, aged twenty-eight, in the middle of September, 1925, was struck a severe blow on the occipital region by a heavy wooden packing case which fell from the top of a nearby pile. A hematoma the size of half a hen's egg developed immediately at the site of the injury. Under local applications this disappeared within two weeks' time. It then reappeared and began to increase steadily in size until by October 2, it had become larger than it was originally. A diagnosis of hematoma was made by Dr. Walter Jones, the surgeon for the insurance company. An incision was made following which there was profuse hemorrhage. The patient was sent to the Hospital for Ruptured and Crippled, under the care of Dr. J. P. Hoguet. Physical examination showed a large swelling in the upper occipital region, the size of half an orange, 3½ in. in diameter, symmetrical in shape, and fluctuating. Roentgen-ray examination and exploratory incision showed extensive destruction of both tables of the skull at the site of the swelling. Under radium-pack treatment and long-continued toxins, the patient made a complete recovery and is in excellent condition at present, more than three years later. Microscopical diagnosis by Dr. James Ewing: "Small spindle-cell sarcoma, very vascular; no bone formation, probably an osteogenic tumor arising from periosteum."

To assume that this man had a pre-existing tumor of the skull at the exact site of the injury, without any previous symptoms, a tumor which grew with such rapidity that it destroyed both tables of the skull in three or four weeks, is neither scientific nor according to common sense.

While Stephens has no new facts to prove that local trauma cannot be an exciting factor in the development of malignant disease, Wainwright, on the other hand, from his own experience contributes new proof that it does and this, in the field of carcinoma wherein it has always been admitted that local trauma plays a much less important

etiological rôle than in sarcoma. In this connection, the following personally observed case may be of interest:

L. F., male, aged forty-nine, had always been well until May, 1908, when he was struck over the right malar region by a steel lever (patient worked on the railroad). A swelling appeared immediately and he consulted a physician on the same day. Poultices were applied for the next two weeks. The swelling continued to increase in size gradually and finally became ulcerated over the central portion. Physical examination on June 5, 1908, a little over three weeks after the injury, showed a man of strong physique, in perfect general health. On the right side of the face, in the malar region, was a tumor the size of a goose egg, movable upon the deep parts, apparently originating in the muscle and fascia. The skin was very much reddened and in the center there was an ulcerated area about 1½ in. in diameter; no enlarged glands. On removing the dressing there was profuse hemorrhage.

Although the condition seemed practically inoperable, I attempted to remove the growth, if possible, and operated on the following day. It was impossible to remove the entire tumor and a portion had to be left behind. The patient was immediately put upon toxin treatment. In July it was possible to remove the remaining portion of the tumor and this was done by my associate, Dr. William A. Downes. In spite of these operations and the toxin treatment, the tumor very quickly recurred, and the patient's general health soon became affected. The treatment was discontinued. The disease progressed with great rapidity and caused death within three months from the time of the injury.

In this case a microscopical examination was made by Dr. W. C. Clark and Dr. James Ewing both of whom pronounced the disease to be carcinoma.

In 1926, in a paper on "Local Injury as a Causative Factor in Bone Sarcoma with Especial Reference to the Medico-Legal Aspects[1] I gave an analysis of 360 cases of sarcoma of the long bones personally observed over a period of thirty-six years, or from 1890 to 1926. In 181 cases or 50

[1] Internat. J. Med. & Surg., July & Aug., 1926.

per cent. there was a definite history of antecedent local trauma. In 133 cases or in 70 per cent, the tumor was noticed within the first six months after the injury and in 30 per cent, it developed within the first month.

This paper contains numerous examples of so-called acute traumatic malignancy in which the sarcoma developed at the exact site of the injury within a very short time (two or three weeks or less) after the injury and in which there was no evidence pointing to even a suspicion of any abnormal condition prior to the injury. It is only fair to state that there are on record a few cases in which a pathological fracture has occurred following a very slight injury and in which a roentgenogram at the time or shortly after showed a primary sarcoma of bone or a secondary carcinoma. Two such cases have come under my own observation, in both of which an attempt was made to secure compensation, in 1 case on the ground that the injury aggravated the pre-existing condition (malignant tumor) and in the other case an attempt was made to ignore the pre-existing tumor even though the roentgenogram showed evidence that it was of long duration and not the result of the injury. These cases are extremely rare, however, and have no real bearing on the question at issue.

We cannot agree with Stephens in his statement that: "until the actual cause of the disease (cancer or malignant tumor) is discovered we cannot hope to get a clear understanding as to what effect, if any, trauma has on its development."

While medical men may be willing to wait until the cause of cancer is discovered before admitting that local injury may be a causative factor in the development of malignant tumors, it is quite evident that the workmen's compensation commissions and the higher courts are not willing to await this uncertain and possibly remote date. Furthermore, we believe the latter are quite right in the statement that most of the medical opinions on the subject at present are but theories. Such being the

case, they have very wisely applied the plain rules of evidence and common sense and reached a conclusion that is not only logical but in accord with the facts. An analysis of a very large number of case reports of bone sarcoma personally observed confirms this opinion. To refuse to accept as a fact something based upon experience and supported not only by a single observation but a great number of observations, simply because we are not at present able to give a complete and scientific explanation of it is not only unscientific but illogical. As has been stated recently by Dr. Robert A. Millikan, one of the most distinguished men in the world of science today: "a great body of definite and certain knowledge can be safely and securely built up on the basis of a few fundamental empirical facts even before we have any fundamental comprehension of the nature of the causes of these facts."

We might as well have said a decade ago that we would not use quinine in the treatment of malaria because not knowing the cause of the disease we had no satisfactory explanation of why this drug should be efficacious. Reasoning in the same manner, we would have refused to use cod-liver oil in the treatment of rickets because, at the time, we knew nothing about vitamins and had no actual explanation of why it should be of benefit.

As regards the medico-legal aspects of the question, while we believe it has been proven beyond doubt that a single local injury may be an important causative factor in the development of both sarcoma and carcinoma, this does not mean that in every case of sarcoma or carcinoma with a history of antecedent injury, more or less indefinite as to location and still more indefinite as to date of occurrence, the injury should be regarded as sufficient to establish a causal relationship. It is only fair that the interests of the insurance companies should be safe-guarded as well as those of the patient; and in my opinion, compensation should be restricted to those cases which fulfill the conditions so admirably laid down by Segond,[1] as follows:

1. The authenticity of the trauma.

2. Sufficient importance or severity of the trauma.

3. Reasonable evidence of the integrity of the part prior to the injury.

4. Correspondence of the tumor to the site of the injury.

5. A date of appearance of the tumor not too remote from the time of the accident to be reasonably associated with it.

6. A diagnosis established by clinical and x-ray evidence, supported when possible by microscopical confirmation.

WILLIAM B. COLEY.

[1] Segond. *Trans. Cong. French Surgeons,* October, 1907.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

HISTORIC ARTIFICIAL LIMBS*

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PART I

IN Goethe's "Goetz von Berlichingen," the monk Martin asks Godfrey's name and the warrior offers him his left hand: "Warum," asks the offended Martin, "reicht Ihr mir die Linke? Bin ich die ritterliche Rechte nicht Werth?"[1]

Godfrey answers: "Und wenn Ihr der Kaiser wärt, Ihr müsstet mit dieser vorlieb nehmen. Meine Rechte, obgleich im Kriege nicht unbrauchbar, ist gegen den Druck der Liebe unenpfindlich; sie ist Eins mit Ihren Handschuh; Ihr seht, er ist Eisen."[2]

Then Martin suddenly stoops to kiss this iron hand which reveals to him the name and heroism of the famous captain.

Thus in Goethe's poem is immortalised the historic artificial limb, which served as substitute for the hand that Goetz von Berlichingen (1480–1562) (Fig. 1) lost in his twenty-third year in the siege of Landshut in Bavaria, and which to quote Goetz' own words: "In Gefekt mehr Dienste geleistet hat als zuvor die Natürliche."[3]

This apparatus, which according to some was the work of an artisan of Nuremberg, according to others of Goetz' own armorer, who lived in Holnhausen, near Jagsthausen, represents the most striking example of antique artificial limbs.

Fate has allowed this curiosity to survive in duplicate, one of a rougher, simpler pattern, possibly the first which the knight used and which is now in the possession, as an heirloom, of the family of Berlichingen-Rossach; the other, an admirable triumph of mechanics, is preserved in the knight's native castle near Jagsthausen (Fig. 2).

A book is placed beside the hand for recording the impressions of visitors. Kotzebue wrote in it: "This hand which fought only for the right, was governed by a heart which beat only for virtue. The hand remains empty . . . Nature, Nature, why hast thou destroyed the heart!" Brockmann, the Viennese actor wrote: "In fiercer times men built hands of iron to fight for liberty; in gentler days weapons and chains to suppress liberty."

There exist numerous copies of this hand of Goetz; one, constructed for the Emperor Joseph II, is in the Museum at Vienna; another is in the armory of Bredow of Wagnitz (Mannheim), and a third forms part of the famous collection of Meyrik in Wales.

But although the hand of Goetz is the most famous, it is by no means the only example of the artificial limbs of past centuries. One which is supposed to have been constructed in the fifteenth century, but which we think to be of later date, is in the Imperial Museum at Berlin. Unlike the hand of Goetz, this one has mobility in the metacarpophalangeal joint of the thumb,

* Translated by M. Forrester Brown, M.D.

while the forearm is connected to the arm by a hinge like the scales of a fish. Another artificial hand was fished up in 1836 in the

FIG. 1. Goetz von Berlichingen.

a high back, whose right leg, amputated about the seat of election, is attached to a pilon with a forked end.

FIG. 2. The hand of Goetz von Berlichingen (second model).

Rhine canal near Alt-Ruppin and is now in the Neu-Ruppin Museum. It has a thumb moving at the metacarpophalangeal joint and fingers jointed in pairs. It seems to us of earlier construction than the Berlin hand. A third is in the private museum of Count Hans Wilczel of Vienna and is said to be of French origin. The thumb is fixed and the fingers move in pairs. We remember seeing several wooden hands of the seventeenth century in the Deutches Museum in Nuremberg.

L. Raymond, quoted by Rivière, describes a mosaic in the cathedral of Lescar (Lower Pyrenees) which according to some authorities (Longpérier) belongs to the Gallo-Roman epoch, according to others (Raymond) to the twelfth century and in which is portrayed a negro whose left leg, lacking the foot, takes its support from the knee from the socket of a wooden pilon, exactly similar to those in use at the present day. Rivière also describes the counter drawing of a fragment of vase found in Paris in 1862 in which is shown, among other figures, a man seated in a chair with

It is clear that, rather than true artificial limbs, in the modern sense of the word, these pictures represent rough apparatus, which now-a-days, as then, the poorer classes of maimed and crippled are in the habit of making for themselves and which are portrayed even more clearly than in prehistoric vases and antique mosaics, in the engravings and pictures of Cornelius Mastys, Gerolamo Bosch and Brughel and in the frescoes of Orcagna in the Camposanto at Pisa and those of Penni in the Vatican.

Herodotus (484 B.C.) records that Egesistratus, after being taken prisoner and chained up, escaped by freeing himself through amputating the foot that was chained. When the wound healed, he provided himself with a wooden leg. In the Talmud there are references to pilons and artificial hands. Pliny the Younger (Book 7, Ch. 29) notes that M. Sergius, after losing his hand in the second Punic war; "dexteram sibi ferream fecit, eaque religata proeliatus Cremonam obsidionem exeruit."

My researches have not enabled me to ascertain the existence of other artificial limbs than those enumerated above. Indeed, information is scarce about them in history. It is easy to understand how the origin of artificial limbs reaches less far back than that of surgical instruments which, as is well known, date back to prehistoric times. The artificial limb is complementary to a surgical amputation; which must not kill the patient by hemorrhage, but produce a useful stump and such an amputa-

tion can only be obtained after the discovery of some method (cautery) of checking loss of blood from the vessels. Prior to that, amputation could only consist in the destruction of segments of a limb by crushing, by which method the stumps obtained were unsuited to any type of artificial limb.[4] It is certain that the lower limb, being both more needful and easier to construct, will have preceded the construction of the upper limb.

There is no lack of iconographic illustrations and very early records of the use of artificial limbs.

On an Italian vase of the fourth century b.c., belonging to the Louvre, and described by Longpérier and Rivière[5] there is represented a cripple supporting himself on a stick, whose lower part forms a pilon. This is less a limb proper than a walking stick which is, so to speak, fused with the deformity. Rivière dilates at length on the deformity from which this comic figure suffers, but he fails to classify it. Charcot and Richer, who repeat Rivière's description, do not commit themselves. It does not seem to us, as Rivière believes possible, that it is a case of congenital deformity. This could only be congenital flexion of the knee; but then the knee would not have the shape portrayed by the artist, and the leg would be differently rotated. We think that this most probably represents a deformity from anterior poliomyelitis. The thigh is much rotated outward and the leg flexed on the thigh. The right foot is covered by the scrotum, the left, to which none of the authorities have paid attention, is in extreme equinus. Such rotation and a flexion deformity of this degree are not rare among the deformities of neglected poliomyelitis. The equinus of the left foot seems to confirm this hypothesis.

Guido Guidi, the Florentine surgeon who practised so successfully at the court of Francis i of France, where he became friends with Benvenuto Cellini, writes in Chapter 7, Book iv in his works collected by his nephew, who had the same name: "Excisa manu, ferrea alia brachii alligatur,

quae usum aliquem ad praebendum et continendum prestat. Exciso crure, sunt qui ligneum parent, quod non solum ad decorem, sed etiam ambulandum accomodatur."

Giovanni Tommaso Minadoi, a surgeon of Rovigo at the end of 1500 who, as medical attendant of the Venetian consuls, travelled widely in the Orient and wrote a history of the war between the Prussians and Turks (1576–88), was doctor to Guglielmo Gonzaga, Duke of Mantua and professor in the University of Padua, asserts that he observed two amputation cases of which one, after the loss of both hands, could by means of apparatus (iron) take his hat off and on, open and shut a purse and sign his name; the other, after the loss of his right hand, could do many acts.[6]

Paolo Giovio relates that the Turkish corsair Horuk, surnamed Barbarossa, lost his right hand in the battle of Bugia (1517) against the Spaniards and had an iron one made "qua ad cubitum religata multis in proeliis postea feliciter usus est."

Duke Christian of Brunswick, who had lost his left hand at the battle of Fleury (1622) had an iron arm made by a Dutch workman.

An artificial hand which has acquired historic importance, because it was depicted and described by Ambroise Paré, is one constructed in Paris in the middle of the sixteenth century by a master smith, and which is called "le petit Lorrain." (Fig. 3.) The hand, which on the dorsum has the form of a steel gauntlet, is attached to the forearm by two metal rods and leather straps. The thumb is rigid and the fingers are kept extended by four springs fixed in the palm. When they are flexed, they are kept so by rachets worked by metal levers. Paré also portrays another upper limb in which the mechanism which controls flexion and extension of the elbow is clearly shown and easy to understand.

We will not linger further in an analysis of apparatus in the centuries before the renaissance of surgery, for our aim is simpler. What has been described is only a

succinct introduction to the description of certain ancient artificial limbs, which are worth studying and will be described.
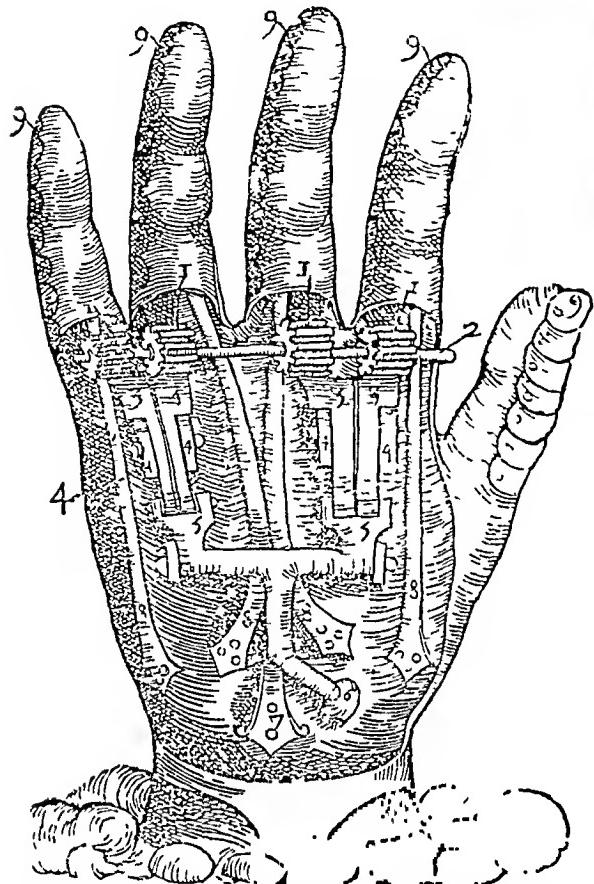
FIG. 3. The hand of "petit Lorrain," demonstrating the mechanism.

Some time ago Dr. Capparoni, noted as a student of medical history, informed me that there existed in the Museo Stibbert[7] in Florence some antique limbs, which he thought worthy of study.

On the recommendation of Ugo Ojetti and thanks to the extreme kindness of Cav. Alfredo Lensi, director of the museum, I have been permitted at my leisure to examine, photograph and draw these limbs collected in the Museum.[8]

By chance, while recently visiting the Museo Poldi-Pezzoli in Milan, I discovered in the Sala delle Armi, an artificial upper limb which has many resemblances to that of Stibbert. This one also I have been kindly allowed to study and photograph through the courtesy of Comm.

Giovanni Beltrami, director of the Museum.

The description of the Stibbert and
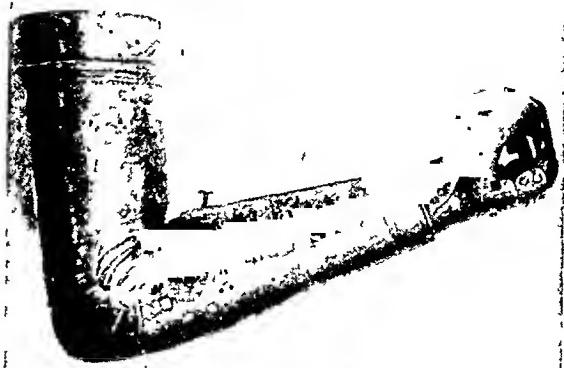
FIG. 4. Prosthesis A (Stibbert).

Poldi-Pezzoli limbs will be followed by that of a curious and original apparatus for deformity of the lower limb, constructed in the seventeenth century, which the engineer Dino Zucchini, its present proprietor, has allowed me to examine and describe.

PROSTHESIS A (STIBBERT)

No. 3819 Fifteenth and Sixteenth centuries.[9] Weight gr. 1330, (Fig. 4).

This prosthesis is of iron and is for a right arm stump. It consists of upper arm, forearm and hand. The opening of the armpiece is furnished with a ring, which by rotating round the long axis of the armpiece, allows small movements of rotation in the apparatus. This ring has a hollow corresponding to the axilla. The armpiece is a cylinder and is joined to the forearm-piece by three metal scales placed in the olecranon part of the apparatus, which are counterpoised in the sheath of the so-called *cubitiera* of the armor (Stibbert Catalogue, 1:188). The fold of the elbow has an anterior protection identical to that found in armor and which the Italian armorers call *alla moderna*.[10]

It is formed of numerous metal scales, overlapping so as to allow a fairly wide range of flexion and extension of the elbow, while protecting the flexure. In the apparatus under discussion there is a range

from 180° extension to 75° flexion. From full extension, the elbow can be flexed in three stages. This movement is controlled by a mechanism hidden in the interior and worked by a metal button projecting on the anterior surface of the forearm. From flexion, extension can be attained in three stages, or in one, by pressing on the button, noted above. The forearm-piece consists of two troughs of sheet-iron rivetted together. The hand is in full supination and is attached to the wrist of the apparatus by three metal screws. It is formed of two parts, the carpometacarpal with which the thumb is continuous, and the digital part with the four fingers which are in semiflexion. The two parts are rivetted together. The rigid thumb is fixed in a position midway between abduction and adduction. The fingers are formed of a dorsal trough, which in its distal part is completed by a ventral trough. The fingers are kept open by a spring fixed on one side to the interodorsal aspect of the thumb and on the other side to the inner wall of the gutter for the fourth finger. Passive closure of the fingers occurs in three stages by means of a toothed lever, which locks in a transverse bridge at the root of the third finger. The lever is controlled by a long handle which projects on the palmar aspect of the wrist and it has its fulcrum on a metal bridge screwed to the inner aspect of the metacarpal trough.

There is only a small range for the fingers, whose pulps in maximum flexion do not touch the palm. The thumb does not touch the index and a space of about 1 cm. remains when they are nearest.

A series of holes all round the edge of the armpiece suggests that the proximal part of the apparatus, in contact with the stump, was completely covered in; but nothing remains to show how it was suspended from the stump or shoulder.

PROSTHESIS B (POLDI-PEZZOLI)

No. 945 in the Museo Poldi-Pezzoli inventory. Sixteenth century [?], (Fig. 5). This apparatus is described in the

inventory as: "Arm-piece in perforated sheet-iron, with gauntlet and artificial hand, also of iron."

Fig. 5. Prosthesis B (Poldi-Pezzoli).

This prosthesis is of iron and is for the right arm stump. It consists of arm, forearm and hand. The armpiece consists of two troughs joined together by two medial hinges. A large buckle on the posterolateral aspect of the posterior trough, and which evidently corresponded to a strap, enabled the anterior trough to be closed and tightened on the posterior one, after the stump had got in. The upper part of the arm in front bears an iron rosette, elegantly chiselled and evidently placed there as an ornament, as in some armor. (Table 141, Stibbert Catalogue.)

The arm articulates with the elbowpiece, which in its turn articulates with the forearm. The respective joints are simply constructed with rivets (medial and lateral). The maximum flexion allowed the elbow is 80° and the maximum extension 160°. Ordinarily the elbow is rigid at right angles. To extend it two manoeuvres are necessary: (1) Extension of the arm on the elbowpiece by pressing on a button in the posterior aspect of the armpiece. This button controls a spring (placed within the armpiece) which when compressed withdraws a spur, this spur projecting against the front edge of the elbowpiece, prevents extension of the arm on the latter. (2) Extension of the forearm on the elbow, by an identical manoeuvre through press-

ing a button on the dorsal aspect of the forearm.

The forearm is cylindrical, formed of a
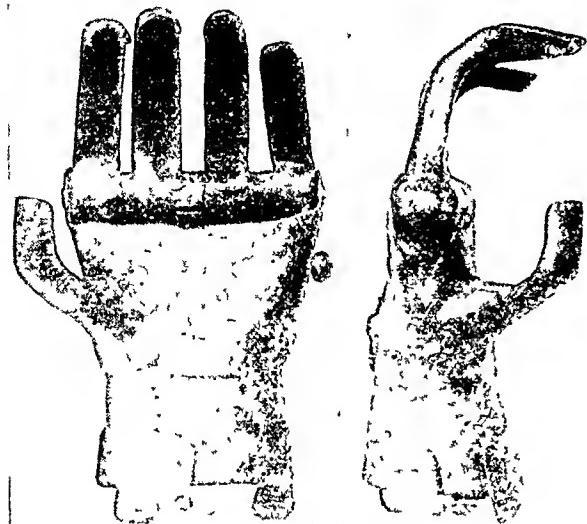
FIG. 6. Prosthesis c (Stibbert).

single sheet of iron with the margins united by rivets on the medial aspect. Both arm and forearm as fenestrated with rectangular openings arranged like fish scales (reminiscent of those in the Imperial Museum at Berlin) and with some, also rectangular, arranged in the longitudinal axis of the limb.

The hand with rigid wrist is nailed to the forearm in a position midway between pronation and supination. The carpometacarpal segment is formed of two pieces, dorsal and palmar, united by nails.

The thumb, rigid in the carpal and phalangeal joints is fixed to the metacarpal joint in abduction, while the second phalanx is semiflexed. The four fingers are united to the metacarpal part by a transverse bar, very oblique and supported in two holes through two ears which spring from the base.

The fingers are fixed to a transverse rod at equal distances from one another, and are semiflexed in the interphalangeal joints. The flexion is greater in the proximal than in the distal joint. The index is shorter than the middle finger, which is longer than the ring finger. The palmar aspect of the fingers and thumb is not cylindrical but levelled into flat surfaces. The nails are elegantly moulded. In its maximum closure the pulp of the fingers reaches to within 3 cm. of the wrist, while the fingers and thumb enclose a space roughly triangular with sides 3 cm. long. From full extension, the fingers can be carried into flexion in seven stages, thanks to a mechanism partly hidden within the metacarpal section, which consists essentially of a ratchet, forming part of the cylinder to which the fingers are fixed and also of two strips of spring-steel, one of them attached to the front wall of the palmar trough, controlled by a button projecting in the palm and articulating by its free end with the ratchet; the second spring, an antagonist of the first, is fixed to the inner wall of the dorsal trough and by its free end engages in a cavity cut in the cylinder referred to above. When the fingers are in full flexion, pressure on the palmar button releases the free end of the first spring from the ratchet, and allows its anatagonist to restore the cylinder to its original position, i.e. with extension of the fingers.

This apparatus has many advantages in construction superior to that last described: Physiological attitude of the forearm; good construction of the hand; correct balance of the grasping interval and irreversibility of the movement into flexion. But these qualities, which would be most valuable for a forearm stump, have little importance in an apparatus which is evidently intended for an arm stump. That this is so is proved by the presence of a mechanism for moving the elbow, a device admirable on its own account for the smallness of the space it occupies and thence for its adaptability to a case of longarm stump.

It is obvious that in the construction of this apparatus, the mechanic, who was certainly an armorer, has been guided by the aesthetic standard of armor. The apparatus, made as it is with the hand in

complete supination and the fingers fully flexed, could only be useful for passively holding the reins in riding.

PROSTHESIS C (STIBBERT)

No. 3316. Fifteenth century. Weight 530 gm. (Fig. 6).

This prosthesis is made of large sheets of metal and forms a left hand. It is indisputably a working hand. There is obvious neglect of any attempt at aesthetic effect. The only accurate reproduction is in the wrinkles on the dorsum of the joints, which are indicated with much grace and truth, and the nail beds, which are fairly well done. Otherwise the whole construction is as rough as possible: Large nails; hinges with rough edges; no attempt to conceal, as would have been easy, the large lever on the dorsum of the hand.

The thumb is solid with the metacarpal part and rigid with flexion in a curve, evidently designed for holding a cylindrical object. The fingers, which show the normal relations of length, are firmly soldered to a single metal cylinder that works round a transverse pivot, which is continuous with the metacarpal portion. The fingers, like the thumb, have no interphalangeal joints, but are curved in flexion. Their palmar aspect, as is that of the thumb, is flat, evidently with the object of eliminating curves that would have given a less firm grip on an object. The fingers can be passively flexed till the pulp of the middle one reaches to within 3 cm. of the palm. The flexion can be graded in six stages, thanks to a ratchet placed round the cylinder from which the fingers spring. Into the teeth of the ratchet fits the free end of a metal arm, which articulates with a lever fixed to the dorsal trough of the wrist.

When the fingers are closed into a fist, pressure on a button at the inner margin of the hand, acting through a lever, frees the ratchet from the metal arm. Then there occurs immediate full extension of the fingers, probably due to a spiral spring enclosed in the cylinder to which the fingers are soldered, a spring which must be fixed to the transverse pivot round which the cylinder turns. This seems the logical explanation, for the actual mechanism, being enclosed in the cylinder, is invisible.

Extension, as well as flexion, can be adjusted in six grades and in each the movement is irreversible. Closure of the fingers leaves a quadrangular space between them and the thumb, but in the final stages it becomes triangular. This gives the optimum grip on a cylindrical object.

The hand was attached to the forearm by four metal plates, three of which, cracked at their bases, still remain attached to the wrist.

(To be concluded)

REFERENCES

[1] "Why do you offer me the left hand? Am I not worthy of knightly courtesy?"

[2] "Were you the emperor himself, you must be content with this. My right, though not useless in war, is insensible to the pressure of love; it is a part of my glove; you see, it is iron." *Deutsche Nat. Litt.*, Vol. 89; *Goethes Werke*, Berl., 8: 252, 1885.

[3] "Has rendered more service in the fight than ever did the original of flesh."

[4] Amputation in the days of Hippocrates is described by the following:

"When gangrene supervenes in a fracture, the soft parts separate quickly; as for the bones, they become detached at the limit of their exposure, but much more slowly. It is necessary to remove whatever dies first below the lesion from the the healthy parts, avoiding as far as possible pain, for patients die from fat embolus." Hippocrates, Moehlieo, T. Oeuvres Complètes. Translated by Littré. Paris, 1844, 7: 379.

[5] Rivière, E. Prothèse chirurgicale chez les anciens. *Gazette des Hopitaux*, No. 132, Nov. 17, 1883.

[6] Jo. Thomae Minadoi Rhodigini. De Humani Corporis Turpitudinibus cognoscendis et curandis. Patavii, apud Franciscum Bolzettam, MDC, Lib. III, Cap. XIV, fol. 95 ret.:

Excogitarunt homines maioribus forte machinamentis deformitatis remedia, dum ferreas manus, in earnem naturalisque praecisac detruncataeque locum subdunt. Ego sane novi nobilem quendam virum, qui eum illi nescio quo casu ex insidiis utraque manus fuerit detruncata, ita ut sine manibus jam viveret, ferreas manus a quodam artifice obtinuit, tam apte cohaerentes, tanta arte et tot librationibus et neseibus conciliatas, ut cum illis pileum et eapite amovere et rursum eapite remittere et bursam solvere atque ligare et calamo nomen proprium perscribere posset. Alium quoque novi eui dextra manus bellici tubuli fulmine icta amputataque fuerit, qui ferream pariter manum sibi magna cum industria comparaverat, ita ut cum illa multa peragcret, quae carnea olim manu etiam perficiebat.

[7] The Museo Stibbert is a museum of antiquities, collected by Mr. Stibbert, an Englishman, who long resided in Italy and at his death left all his possessions to the English Government, with the proviso that if they were not accepted, they should be given to the city of Florence. The English Government having refused the bequest, the city of Florence took possession of the Museum, which excels many in Italy and competes with the most famous abroad by the richness of its collection of weapons of every age and country. The magnificent catalogue of the Museum is the work of Alfredo Lensi, head of the Ufficio Antichita e Belle Arti of the city.

[8] The limbs are enumerated in the catalogue of the Museum as Nos. 3816, 3817, 3818, 3819, 3820 and depicted in Table 174.

[9] The number corresponds to that in the catalogue of the Museo Stibbert. The date is that thought probable by the Director of the Museum.

[10] "Only rare examples are found from the beginning of the sixteenth century. They were in frequent use in the second half and also for most of the seventeenth century." Angelucci—Catalogue of the Royal Armory at Turin, lvi, 1890, p. 69.

BOOK REVIEWS

No reviewer's testimony can add to the stature of Hugh Hampton Young, urologist. This work[1] emphasizes once more the everlasting indebtedness of the medical profession in general, and of practitioners of urology in particular, to the genius of the director of the Brady Urological Institute. To Young's sound practical judgment, begotten by an extraordinary experience, has in this instance been added that of Charles A. Waters, Assistant Roentgenologist in the same institute. The result is a work distinguished by acute analysis and scholarly presentation of what heretofore has been a relatively unexplored field of urological activity.

Much of the advancement of urological roentgenology originated at the Brady Urological Institute. The substitution of a harmless opaque medium for the highly toxic media first used in pyelography was the work of one of its graduates. There, too, was designed and constructed the first combined cystoscopic-roentgen-ray table, making the pyelogram a more simple and scientifically accurate process. Young's adaptation of the Bucky diaphragm, with grids running transversely instead of longitudinally, permitted the taking of stereo-

[1] UROLOGICAL ROENTGENOLOGY. By Hugh H. Young M.D., F.A.C.S. and Charles A. Waters, M.D., Annals of Roentgenology, Vol. VII. Edited by James T. Case. 4 to, cloth. Pp. 545, 494 illus. N. Y., Paul B. Hoeber, Inc., 1928.

scopic films of the entire genitourinary system, and widely extended the diagnostic possibilities of urological roentgenology.

The scope of this work has purposely been narrowed, for two years ago the senior author published his monumental "Practice of Urology." The present volume treats specifically of urology in all its relations to roentgenology, and trenchantly discusses, inter alia, stereoscopy, ureterography, cystography, diverticulography, vesiculography, ampullography, vasography, topography of the kidneys, anatomy of the pelvis and calices, renal anomalies, renal tumors, traumatisms and foreign bodies of the urinary tract.

The opening chapter deals with the practical aspects of a combined roentgenological and urological study of the genitourinary tract. The technique of pyelography is lucidly set forth. Preference is given to the gravity method of introducing the opaque medium. The authors make a bilateral pyelogram unless the condition of the patient contraindicates it. They also procure stereoscopic views whenever possible, stressing their importance especially in renal tuberculosis.

The technique of cystoscopic examination is complete in its delineation. Respecting pyeloscopy, the reviewer believes that most urologists will agree with the authors in their estimate of the advantages and disadvantages of fluoroscopy in diagnosis; for, while it is interesting to observe the filling of the calices and visually to determine the emptying time, the actual opportunities for observing pathological conditions are few, the chance of error is not negligible, and no permanent record is obtained, unless the examination is prolonged to make pyelograms with consequent fatigue and danger to the patient. What is said in respect of the proper position of the patient upon the table will be appreciated by every urologist who has cystoscoped a patient upon the ordinary roentgen-ray table, since it is essential to make the pyelogram in the horizontal position as well as the vertical.

The section on renal fluoroscopy by Braasch, from an as yet unpublished monograph, is a convincing refutation of the objections often made against the use of fluorosopy in the removal of multiple renal stones. There is urged the value of both fluoroscopy and roentgenograms at the operating table, particularly in the case of calculus, and Quimby's method of using roentgen-ray films is explained.

The authors remind us of many anatomical and physiological aspects of urological problems, the significance of which may be overlooked because of the proclivity of the specialist to exaggerate factors peculiar to the subject of his intensive study. Thus, in the interpretation of ureterograms, it is remarked that peristalsis often continues during the taking of the film, and waves of contraction will be seen in films of a normal ureter, creating at times the false impression of the presence of stricture. Again, it is noted that, during exposure time, the movement of a ureter filled with opaque medium will occasionally cast a wider shadow than the normal, giving the erroneous appearance of ureteral dilatation.

The discussion of urogenital infections and infestations, of tuberculosis of the genito-urinary tract, and of urinary lithiasis is vivid and concrete. Here are none of the generalities wherein error lurks. The case method is the vehicle of development of these topics and the cases are made luminous by striking illustrations. Here as elsewhere the illustrator, Mr. William P. Didusch, has done his part admirably. From the colored plate of hypernephroma, with hydronephrosis and diffuse glomerular nephritis, which forms the frontispiece, to the deliniation of the pyelogram which it accompanies, shown on page 420, the illustrations are characterized by a fidelity to detail and a pictorial sense that visualize the minutest anatomical aspects of the subject.

The publishers have given the volume the sumptuous dress to which a work of such merit is entitled.

It is not too much to say that no practitioner of urology will want to be without this work.

BOOKS RECEIVED

All books received by The American Journal of Surgery are listed in this column as soon as possible after their receipt and this must be considered as adequate acknowledgment. Books that the Editor considers of special interest to our readers will be reviewed in a later issue.

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A STUDY OF THE SQUARE KNOT*

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PURPOSE OF ARTICLE

THE object of this paper is fourfold: First, to state the basic laws which govern the making of square knots; second, to present a "physiological method for tying knots," which centers the attention upon the movements made by the hands (the active elements in knot-making), and in this respect varies from the usual custom of confining the interest to the relation of the cords (which are purely passive elements); third, to stress the importance of a factor which may be called "the plane of the loop," a fundamental in the tying of knots, hitherto overlooked or underemphasized; fourth, to describe several technical maneuvers based upon these points in an attempt to facilitate the application of the square knot[1] to any situation arising in routine surgical work.

[1] A DEFINITION OF TERMS

A *simple knot* is one in which a complete loop or circle has been formed in the material used, and one end has been made to continue completely around the other end (see Fig. 1a), then to pass through the loop.

The moving end of cord is a term used to designate the free end or the one which wraps around the standing end during the formation of the knot.

THE MERIT OF THE SQUARE KNOT

The square, flat or reef knot is accepted as the surgical tie of choice (Fig. 1d). When properly made this knot may be absolutely relied upon. It will not slip, since the greater the strain from within the greater the security. Little space need be devoted to a discussion of its relative

The standing end of cord is the portion which does not move, but is wrapped around *by* the moving end during the formation of the knot.

A *double knot* or "layman's knot" is one made by superimposing one simple knot upon another.

Components of a double knot: The first simple knot in a double knot may be referred to as the first component, and the second simple knot as the second component.

The square knot is a double knot made by superimposing one simple knot under another in such a manner that the two stretches of cord pass together under the loop of the second component and are not separated by this loop (see Fig. 1d).

The granny knot is a double knot made by sumperimposing one simple knot upon another in such a manner that the two stretches of cord do not pass together under the loop of the second component, but are separated by this loop (Fig. 1c).

merits, for sufficient has been written in surgical literature to establish the special value of this particular variety of tie. It
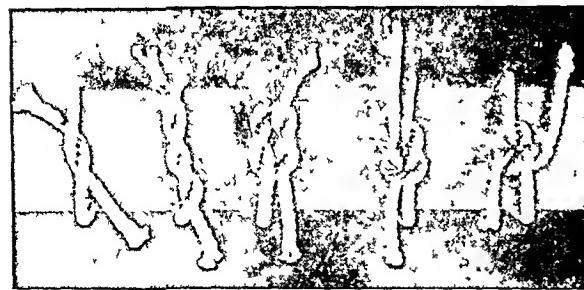
FIG. 1. Common knots; a, simple knot; b, friction knot; c, granny knot; d, square, flat, or reef knot; e, "twisted" square knot.

has been repeatedly stated that time spent in the mastery of the square knot will be amply repaid throughout professional life.

DIFFICULTIES WITH THE SQUARE KNOT

A knot seems, upon superficial consideration, to be essentially simple. The assumption seems reasonable that little could remain unsaid about anything so long and constantly in use in so highly trained a profession. Yet even a casual review of the subject shows that much has been taken for granted in the use of the square knot. More careful study demonstrates that the practical application of this knot is at present far from satisfactory. Problems of a surprisingly intricate nature are involved. The surgeon must do more than simply acquire the knack necessary for creating square knots. The difficult thing for an operator is to become able to make this form of tie with safety and with ease under any circumstances which arise in his work. There are instances in which both ends of the material to be tied are free and movable, as in tying ligatures, and others in which one end or the other is fixed, as in fastening sutures; at times the knot must be tied in the depths of a wound, at others, the free cord end which is left for tying proves too short for digital manipulation; in all instances the material used is fine, the time at command is short, and

the knots must be tied with gloved fingers which are often wet with blood or pus. There is no single method for making the square knot which proves adequate for all these situations. The efficient operator must be practiced in more than one maneuver. There is an appropriate tie for each occasion and the surgeon faces the alternatives of becoming versatile in the use of the square knot or remaining content with methods which are at times awkward and at others inadequate or giving up this "surgical tie of choice" for the less secure "granny knot" or the more bulky "triple knot."

Difficulties with the square knot are exceedingly common. Fifty-four experienced surgeons were consulted concerning their use of the square knot. Observation and discussion, in all but seven instances, disclosed one or more of the following:

1. The habitual use of granny knots, carefully tied under the impression that the method used was creating square knots, or deliberately employed because square knots proved too troublesome.

2. The necessity of observing each individual tie as it was being made, in order to be sure of the variety of knot which would result.

3. The formation of knots which, though created upon the principle of the square knot, proved upon completion to be of a "twisted," sliding, or insecure variety.

4. Reliance by the surgeon upon a single maneuver for making all his square knots. Such a method nicely met certain situations, but was totally inadequate in other circumstances commonly encountered while operating.

Methods of teaching the square knot involve still more difficult problems. The art of making this tie has been handed down by the master surgeon to his apprentice. It has become a trandition that the maneuver for making a knot must be learned through direct observation and that it is difficult or impossible to teach the actual technical steps by means of a book or printed demonstration. Little is

found, therefore, in surgical texts concerning knots. Numerous works of several volumes make no mention of this important subject. The flat statement is frequently encountered that "knots cannot be taught in books."

VARIABLES

Naturally there must be an explanation for such a status. The confusion which exists within the subject of knots is due to the presence of a large number of "variables." Thus, every square knot is composed of two simple knots which may be tied in many different ways. There are two hands to do the tying, and each hand may be employed in a number of different manners. The material to be tied has two ends and the cords may be crossed, twisted, or wrapped around one another in a wide variety of fashions. There are many planes in which the knot may be tied, etc., etc. These variables may be combined indefinitely. Confusion is inevitable where so many factors remain inconstant. Thus, either of the two ends of cord may be made the moving end for either or both simple components of the square knot, or the two cord ends may be alternately used. Again the two hands may be utilized together for making either or both components; either of the two hands may be used singly for both simple knots; or the two hands may be alternately used for first one, then the other component. These represent but a few of the variables. Over a hundred different ways may readily be demonstrated for creating a square knot. Furthermore, while creating a knot, many parts move simultaneously. The expressions used to describe these movements will vary widely according to what particular part is made the center for attention: the ends of cord, the points of crossing, the loops, the planes, the hands, etc. More than a thousand accurate descriptions may be made of methods for tying this knot. In spite of all this, so long as a single variable remains undefined in any description or demonstration, there exists a gap between the one teaching the knot and the one seeking to learn the knot, and this constitutes a source for error.

The presence of "variables" explains a general and genuine dissatisfaction among both students and surgeons as to the state of their knowledge concerning knots. "Variables" account for a total lack of standardization of this elemental and basic surgical subject. Because of the many "variables" there are both truth and humor in the definition of a knot which appears in the medical dictionary: "A knot is a *confusion* of cords."

THE PHYSIOLOGICAL METHOD OF TYING KNOTS

The physiological method reduces this complex subject to one of relative simplicity. Since this method eliminates variables, precision becomes possible and the square knot may be surely, safely and uniformly tied. The maneuvers become automatic, doing away with the necessity for direct vision. Versatility in the use of this tie is no longer difficult, and the square knot may be employed with freedom and ease in all situations.

The physiological method, as the name implies, is based upon the normal functional movements of the hands. It was evolved through answering the following question: "Why do laymen always tie granny knots?" There can be no other answer than that something is "natural" about this form of tie. The double knot of the layman is uniformly of this variety. It is equally certain that there is something "unnatural" about making square knots, for they prove universally difficult. It is logical to anticipate that if one could learn exactly of what the "natural element" with granny knots consists, and could learn precisely what "artificial or unnatural" elements are essential to square knots, the difficulties would largely disappear. Uniformity in the use of these specific elements should invariably yield the desired knots. This premise has proved well founded.

THE MANEUVER FOR TYING THE GRANNY KNOT

Analysis shows that each layman has his

the layman's variety. To repeat with the same hand in making the second component the motion which was used for the
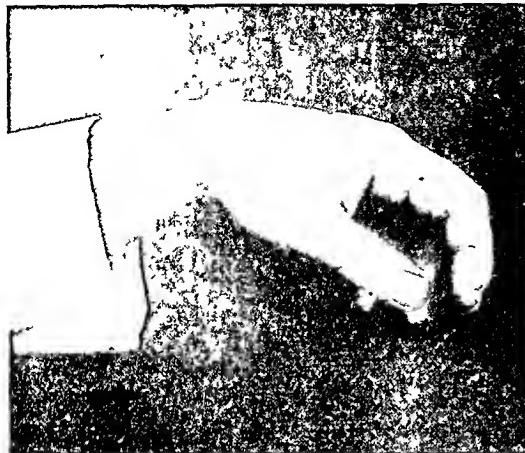
FIG. 2. Flexion-pronation posture. This is the posture of rest and ease. Most motions are made within this position which may be termed inherently "natural." It is two of these "natural" motions made with a single or "favorite" hand which account for the fact that a layman's knot is always of the granny type.

FIG. 3. Extension-supination posture. This posture is difficult to assume and tiresome to maintain. It may be termed "an unnatural motion." When made by a single hand, the square knot must always contain one such "unnatural" motion. It is this factor which makes the square knot difficult to master.

favorite hand. With the majority this is the right hand. To be "dexterous" means to work deftly, or with inherent ease, that is, in a "right-handed" manner. Routine acts are habitually performed with the favorite hand and the opposite hand is either not used or merely plays the part of assistant. In addition to a favorite hand there is a favorite motion, which is pronation (Fig. 2). Prone means literally, bent downward, and pronation signifies the posture of rest. Thus, while extension of the fingers or wrist and supination of the forearm constitute more tiresome, difficult or unnatural motions (Fig. 3), flexion and pronation may be characterized as restful, easy or natural. The layman, as a rule therefore forms his double knot by making two pronation motions of his right forearm and this yields a granny knot. It is found true similarly that every combination of two identical motions made with the same hand will produce a granny knot. So long as one continues to do what is physiological, natural or easy (and there are many combinations of such motions), his double knot will be of

first component will *always* result in a granny knot.

MANEUVERS FOR TYING SQUARE KNOTS

A square knot may be obtained only through performing some less natural movement. This "artificial" element may consist of (1) ambidexterity (using different hands for the two components), (2), bimotility (using opposite motions of one hand for the two components), (3), a special backward looping of the cord end (predetermining the relation of the cords for the second component).

(1) *The Law of Ambidexterity.* It will be found in tying double knots that if identical motions are made, first with one hand, then with the other, in making the two component simple knots, a square knot will always result. The law may be stated thus: *Identical movements of opposite hands will insure a square knot.* Care must be taken in testing the accuracy of this statement by using a piece of cord to make sure that the actual tying of the separate components is done with the separate hands and that the movements of the two
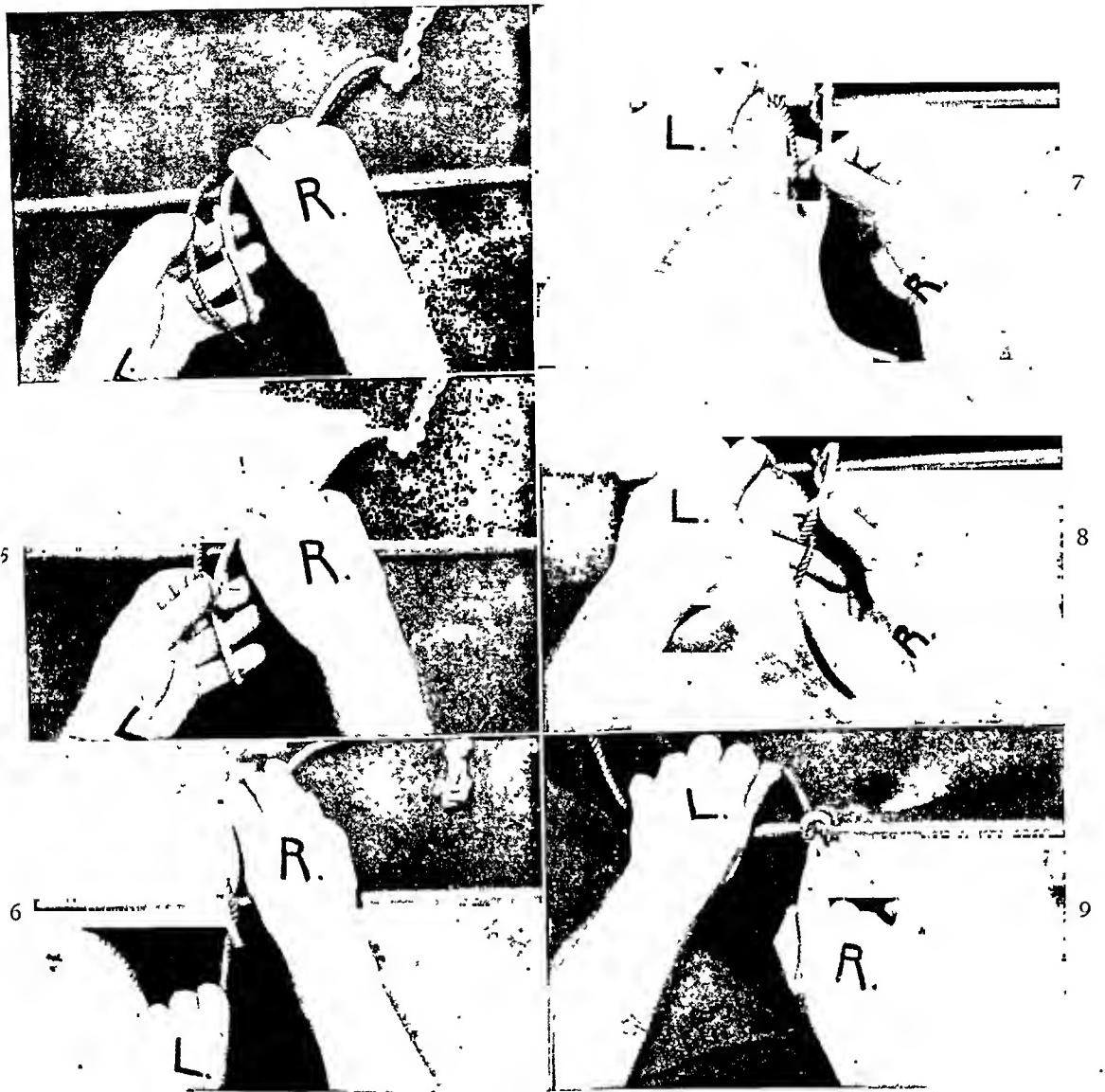
FIGS. 4–9. The Maneuver of Ambidexterity.

FIG. 4. The two ends of cord are grasped by the thumbs and the forefingers of the two hands. A complete loop is formed. The free fingers of either hand (in this instance the left) are inserted into the loop, palm upward.

FIG. 5. The extremity of cord held between the thumb and forefinger of the hand within the loop is made the moving end (black cord.) This moving end of cord is carried by the thumb and index finger over the standing end and inserted into the space between the middle and ring fingers of the same hand.

FIG. 6. The hand is now withdrawn from the loop, pulling the moving end of cord through the loop by means of the middle and ring fingers. The first component knot is finished by straight-line traction in the plane of the loop. (Flexion-pronation motion of *left* hand.)

FIG. 7. Without dropping either cord end or displacing the first knot, another loop is formed. The free fingers of the opposite hand (R) are inserted into this loop, palm up.

FIG. 8. The extremity of cord held between the thumb and index finger of this hand (R) is made the moving end (white cord) and is carried by these fingers over the standing end and inserted into the space between the middle and ring fingers.

FIG. 9. The hand is now withdrawn from the loop pulling with it the moving end of cord. The square knot is completed by straight-line traction in the plane of the loop. (Flexion-pronation of *right* hand.)

hands are kept identical in every respect (Figs. 4–9).

An interesting proof of this law is found in the following fact: A layman who has never practiced making square knots and whose efforts repeatedly yield granny knots because he adheres to two identical motions of his favorite hand, when told to use first one hand, then the other (when introduced to the maneuver of ambidexterity), will at once, and without effort, automatically create square knots. Furthermore, so long as he makes double knots after a truly ambidextrous fashion, he will find that he is now quite unable to make the granny or layman's knot. That is, the granny knot proves as difficult under the conditions of ambidexterity as does the square knot under the conditions of unidexterity.

(2) *The Law of Bimotility.* In tying a double knot by means of one hand only, a square knot is always obtained when the two component simple ties are made by opposite motions. This law may be stated thus: *opposite motions of the same hand insure a square knot* (Figs. 10–15). As already noted, the reason that laymen tie granny knots is because they make two identical pronation movements. An analysis of the motion shows that the hand is closed by flexion of the fingers and thumb with the forearm simultaneously pronated, thus drawing the free end of cord toward the ulnar side of the hand. Two such motions yield the granny knot regardless of which hand is used, how the cords are crossed, or whether one end only or alternate cord ends move for the two components. The square knot may be obtained only when one component is tied by this normal or physiological motion just described and the other component by an opposite motion. Thus, while in making the layman's knot the free cord end passes twice to the ulnar side of the hand, in making the square knot the free cord end passes once to the ulnar but once toward the radial side of the hand. By means of a stop watch or by counting slowly aloud it will be seen

that the pronation-flexion motion is rapid and the supination-extension motion less rapid. This explains the unnatural element and the source of difficulty with square knots, which when tied with a single hand must always include one such motion combined with an opposite motion.

(3) *The Law of the Backward Looping of the Cord.* A third maneuver, which however cannot be classed as a physiological method of tying, will insure the forming of a square knot; namely, to predetermine the correct relation of cords for the second component tie. If, after the first component tie is completed, either end of cord is looped backward upon itself in such a fashion as to remain upon the same side as that upon which it emerged from the loop of the first knot, a square knot always results, regardless of the exact movements by which the second component is completed. The law may be stated thus: *The same cord end looped backward upon the same side insures a square knot* (Figs. 16 and 17). To predetermine thus how the cords shall cross requires direct vision, careful palpation, or deliberate memory; that is, it is not an automatic process. However, this method is safe and may be used when an interval has elapsed after making the first component and the method by which this was made has been forgotten. It will also enable an assistant to complete a second component of a square knot, should this necessity arise, when the first component has been made by the surgeon. In tying in the depths of a wound this law may be used: having palpated the direction in which one end of the cord has pierced the loop of the first component, bend this same end backward upon itself, determining by palpation that it remains upon this same side, and the square knot must always result. The objections to this method are that it is not sufficiently smooth or rapid for most occasions and that it requires too much manipulation of cords and changing of hands.

Summary. These maneuvers make it
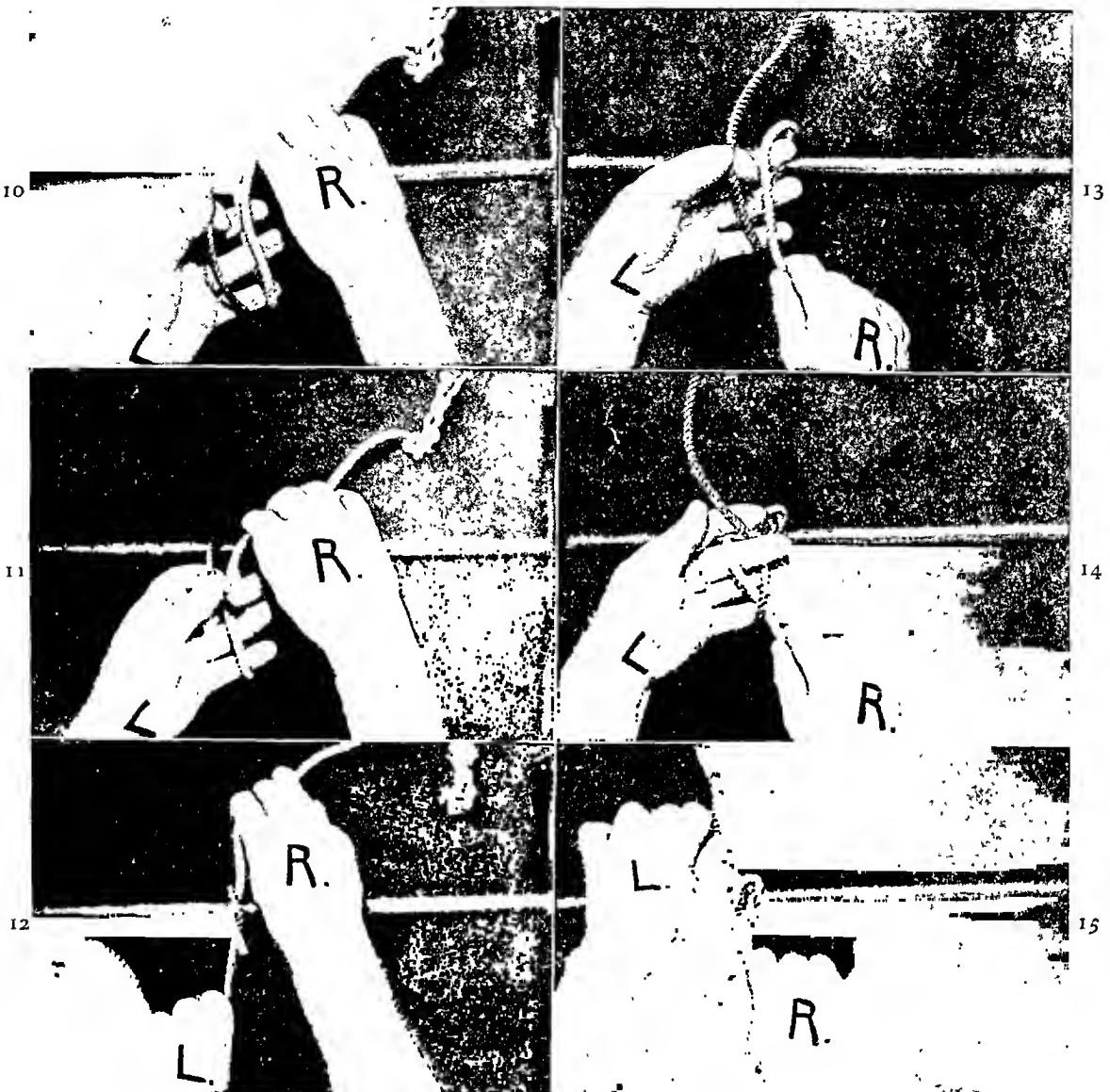
FIGS. 10–15. The Maneuver of Bimotility.

FIG. 10. The free end of cord (black) is grasped between the left thumb and forefinger. A complete loop is formed, keeping the free end of cord to the left of the standing end. The free fingers of the left hand are inserted into the loop.

FIG. 11. The free end of cord is carried by the thumb and forefinger over the standing end of cord and inserted into the space between the middle and ring fingers of the same hand.

FIG. 12. The hand is now withdrawn from the loop, pulling the moving end of cord through the loop. The first component knot is completed by straight-line traction in the plane of the loop.

FIG. 13. Without displacing the first knot, a second complete loop is formed in the same plane as the first. The free fingers of the left hand are now inserted into this loop, palm upward.

FIG. 14. The free end of cord now held between the thumb and forefinger of the left hand is carried by these fingers, over the standing end of cord and inserted into the space between the middle and ring fingers (L).

FIG. 15. The hand is now withdrawn from the loop, carrying with it the moving or free end of cord. The square knot is completed by straight-line traction in the plane of the loop.

possible to tie square knots by a wide variety of movements. The square knot may be tied as quickly, safely and auto-

A plane is created whenever a cord is bent, or looped. A plane is defined as "a surface such that if any two points in it be
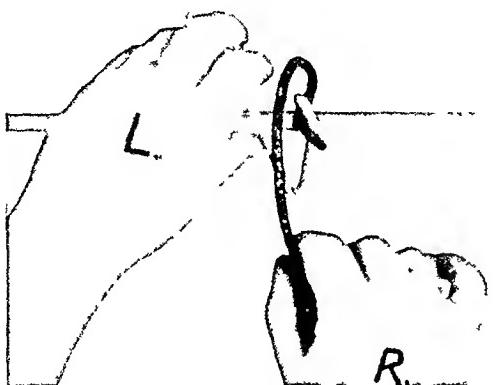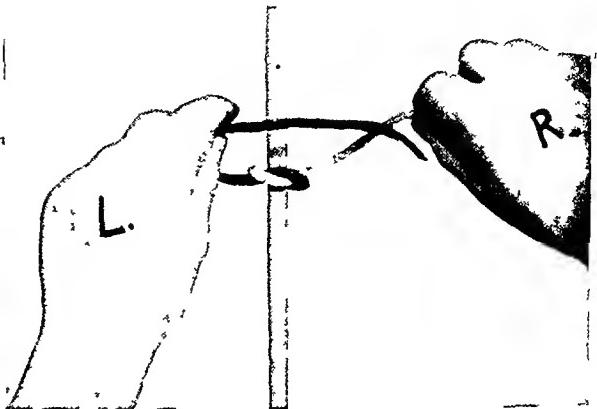
FIG. 16.   FIG. 17.

FIGS. 16–17. The Maneuver of Looping the Cord Backward.

FIG. 16. (Plane of loop in operator's saggital plane.) The free or moving end of cord has been bent backward upon itself in such a fashion as to cross the standing end upon the same side of the plane of the loop for both component simple knots. (The square knot is completed by passing the black cord through the loop.)

FIG. 17. (Plane of loop parallel to operator's frontal plane.) The free or moving end of cord has been bent backward upon itself in such a fashion as to cross the standing end of cord, upon the same side of the plane of the loop in making both component simple knots. (The square knot is completed by passing the black cord through the loop.)

matically as any less desirable knot, once the special considerations of ambidexterity (identical motions of opposite hands), bimotility (opposite motions of the same hand), or a special backward looping of the cord (the same cord end looped backward upon the same side) have been thoroughly understood.

THE PLANE OF THE LOOP

The reason why square knots are synonymously called "flat knots" is that when properly tied both simple components lie in one plane. It is essential to the security of this tie that account be carefully taken of the plane in which the knot is created. No reference to this factor is found in surgical literature. The fact that textbooks dealing with surgical technique repeatedly illustrate as square knots (Fig 1e) ties which are of a twisted and insecure variety, further attests to the neglect of this important matter. Yet a square knot must fail to deserve its reputation for reliability and is no better than a granny knot unless the interrelation of the cords is correct in every respect.

joined by a straight line, this straight line will lie wholly within this surface." By "the plane of the loop" is meant the plane formed when a cord is looped for the formation of any simple knot (Fig. 18). To complete properly a simple knot the traction and countertraction necessary in tightening the tie must be kept within the same plane as that of the loop of the knot (Fig. 19). If the two cord ends are not pulled directly away from one another within this plane the simple knot becomes displaced into a sliding loop (Fig. 20, also Fig. 1e). A truly square knot, then, can only be created when both simple components lie in the same plane and are completed by straight-line traction in the plane of the loop (Fig 21).

It will be found of great advantage to keep the plane of the loop, whenever feasible, within the sagittal plane of the operator's body. When the knot is thus tied within the sagittal plane the cord ends will be pulled toward the operator with one hand and away from the operator with the other (Fig. 23). Thus the surgeon's right hand remains upon his right side and
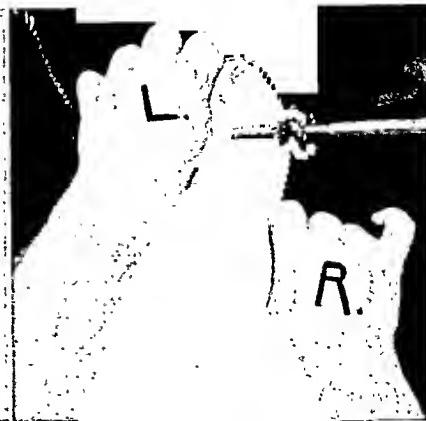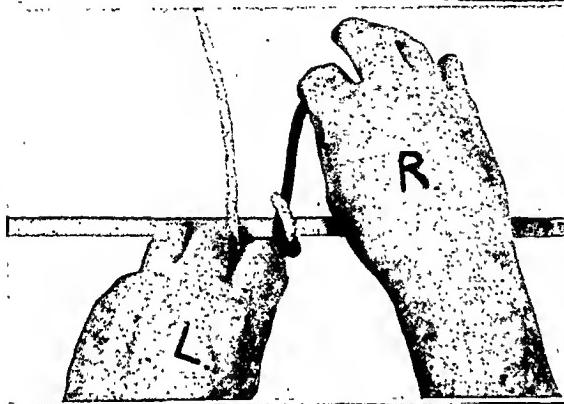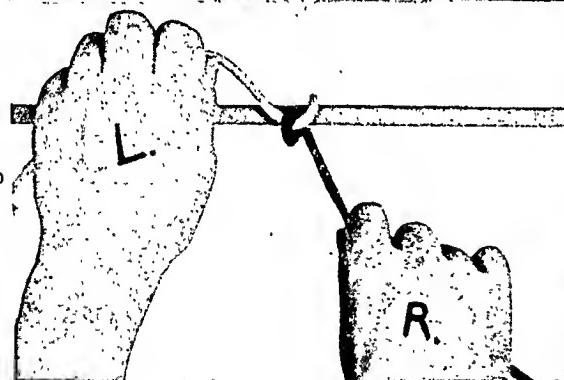
FIG. 18. When a cord is bent or looped a plane is formed. The plane created while making a simple knot may be referred to as "the plane of the loop."

FIG. 19. When tightening a simple knot the traction and countertraction required must be made in a straight line and within the plane of the loop.

FIG. 20. Displacement of the simple knot when the plane of the loop is disregarded and the traction and countertraction fail to follow a straight line or to remain within the proper plane. A twisted knot or sliding loop is created, which is insecure.

FIG. 21. No changing or crossing of the hands is necessary when the square knot is created within the operator's saggital plane.

FIG. 22. When the square knot is formed with the plane of the loops parallel to the operator's frontal plane the hands must always be changed or crossed during the process of forming the knot.

FIG. 23. Whenever feasible all square knots should be made with the plane of the loops in the operator's saggital· plane.

his left hand upon his left side. This eliminates all necessity for crossing, twisting, or changing the hands, while tying the knot. The maneuver is more natural and smooth when knots are made in this manner and they are also more secure since the tendency to disregard the plane of the loop is thus eliminated.

When the plane of the loop is parallel to the surgeon's frontal plane, on the other hand, it becomes impossible to create a square knot without either changing, rotating, or crossing the hands (Fig. 22). Changing the hands is slow and is not always feasible. Rotation of the cords renders the knot insecure by the formation of a sliding loop. Crossing the hands is awkward and obstructs vision for both operator and assistant. Thus it is apparent that there are important advantages in keeping the plane of the loop within the operator's sagittal plane.

When the surgeon finds, during the course of his work, that the loop of the knot he must tie does not lie in his sagittal plane, he may favorably change the relationship by a slight rotation of his trunk, thereby bringing his sagittal plane approximately to that of the loop, and thus he can tie all knots without rotation of cords or changing of hands. The assistant, also, may so manage the hemostats as to bring the loop of the ligatures into the operator's sagittal plane.

Before beginning the copy of a knot it should be inquired "Is the loop illustrated in the operator's sagittal plane, or in some other plane?" It is impossible to follow exactly either a tutor or a series of cuts unless the loop is copied within the correct plane. This point seems obvious when called to attention, yet when not observed, it becomes an elusive cause of failure to obtain the desired tie. For example, it is common practice for a beginner to practice knots by placing the cord around his own thigh, thereby predetermining that the loop of his knots shall lie parallel to his frontal plane rather than in his sagittal plane. If the loop illustrated is in the same plane as the loop upon his thigh, his efforts may be successful, but if the loop illustrated is in any other plane, no amount of effort will enable him to follow exactly the illustrated knot.

These points make apparent the importance of the plane of the loop. In the description of the selected maneuvers to follow, further reference is made to practical methods for observing this factor while operating. On account of the advantages of tying within the sagittal plane, the maneuvers to be described are made with all loops in this plane.

SELECTED MANEUVERS

The following selected maneuvers will be described: A. Tying the square knot by means of both hands. B. Tying the square knot with one hand only. C. The square knot for an assistant. D. Tying the square knot by means of instruments.

The statements of laws and principles, of which the entire article has thus far consisted, have of necessity been dogmatic. The statements to follow are less dogmatically advanced since they are merely suggestions as to certain chosen or selected maneuvers for the application of these laws. For these selected details of technique may be substituted others of the individual surgeon's choice, providing the laws be respected. To adhere to the laws is necessary; to follow the suggestions is optional.

Tying the Square Knot with Two Hands (Ambidextrous Method). When both ends of the cord to be tied are free, are of approximately equal length, and are sufficiently long to be readily handled, the square knot may to advantage be tied by making the first component by means of one hand, and the second component by means of the opposite hand. Examples of situations admirably met by the ambidextrous method are the tying of single ligatures and of such interrupted sutures as are used in the repair of an inguinal hernia. Procedure (Figs. 4 to 9):

1. The two ends of cord are grasped by

the thumbs and forefingers of the two hands, and a complete loop is formed.

2. The free fingers of either hand are inserted into the loop, palm upward.

3. The extremity of cord held between the thumb and index finger of the hand within the loop is made the moving end. This moving end of cord is carried by the thumb and index finger, over the standing end, and is inserted into the space between the middle and ring fingers of the same hand.

4. The hand is then withdrawn from the loop, pulling the moving end of cord through the loop by means of the middle and ring fingers.

5. The first tie is completed by straight-line traction in the plane of the loop.

6. Without dropping either cord end another loop is formed.

7. The free fingers of the opposite hand are inserted, palm up, into this loop.

8. The extremity of cord held between the thumb and index finger of this hand is now made the moving end, and is carried by these fingers over the standing end, and inserted into the space between the middle and ring fingers.

9. The hand is then withdrawn from the loop, pulling with it the moving cord end.

10. The square knot completed by straight-line traction in the plane of the loop.

It will be noted that in following this procedure the square knot is made by means of identical motions of the two hands, the first component being completed by a flexion-pronation movement of one hand, and the second component by a flexion-pronation movement of the opposite hand.

Tying the Square Knot with One Hand (*Unidextrous Method.*) When only one extremity of the cord is free and the other carries a needle and needleholder or a ligature spool, or when the two extremities of cord are of considerably unequal length, the square knot is, to advantage, tied by means of a single hand. When the knot is tied by a single hand there is but one free end of cord which remains the same in both components, thus it is not necessary to carry any instrument or undue length of material through the loop of the knots.

It seems advantageous for the surgeon, when using the unidextrous method, to use his left hand, thereby leaving the right hand free to handle the needle holder or other instruments. To use the thumbs and forefingers of both hands in place of making the tie by the unidextrous method would necessitate the emptying of the hands for each knot and result in a continuous setting down and picking up of instruments. The unidextrous method, then, makes one hand serve the usual task of the two hands, thus in a sense creating an extra or free hand.

The particular maneuver of biomotility here recommended is a left hand tie made with the loop in the operator's sagittal plane. Procedure (Figs. 10 to 15):

1. The short free end of cord is grasped by the left thumb and forefinger.

2. A complete loop is formed, keeping the short cord end to the left of the long or standing cord end. The free fingers of the left hand are inserted into the loop.

3. The short end, grasped between the left thumb and forefinger, is now carried over the long end of cord and inserted into the space between the left middle and ring fingers.

4. The hand is now withdrawn, pulling the short cord end through the loop.

5. The first component is completed by straight-line traction in the plane of the loop.

6. Without displacing this first knot, a second loop is formed, that is, a second complete loop is created within the same plane as the first.

7. The free fingers of the left hand are inserted into this loop, palm up.

8. The short end of cord now held between the thumb and forefinger is carried by these fingers over the long end of cord and inserted into the space between the left middle and ring fingers.

9. The hand is then withdrawn from the loop, carrying with it the short end.

10. Straight-line traction in the plane of the loop completes the knot.

It will be observed that in following this procedure, the free cord end is carried once *toward* the operator and once *away* from the operator, and that the square knot is made by two opposite motions of the left hand, the first component being made by a flexion-pronation motion, and the second component by an extension-supination motion, as described in the paragraph on the maneuver of bimotility.

c. The Square Knot for the Assistant.

The chief surgeon, while operating, may ask his assistant to tie a knot. When the assistant may handle both ends of the ligature or suture, he himself becomes, for the moment, an operator and may use methods of tying which have already been described. When, however, the chief surgeon is suturing and retains in his own grasp the needle holder and the long, or standing end, of suture, asking the assistant to tie with the short or free end, the situation is not adequately met by the particular selected maneuvers which have been illustrated. Obviously the maneuver of ambidexterity cannot be used, since this requires that both ends of material pass through a loop. Similarly the maneuver of unidexterity is not adaptable since this requires the use of enough material to wrap around the entire hand, and this may call for more of the suture than has been left for tying, or may cause the needle to become unthreaded or the surgeon's hand to be jerked upon.

The aims of the assistant should be to form a square knot both safely and quickly while using the smallest feasible amount of material and causing the least possible inconvenience to the operating surgeon. These aims are best met by using the thumb and forefinger of both hands for forming both simple components of the square knot (two-hand tie). The standing end of cord (held by the surgeon) should never be picked up by the assistant with the whole hand but rather should be "hooked up" by one finger only (Fig. 24),

and the motion for tying confined almost entirely to the free cord end. Again, during the process of tying, the assistant should avoid the natural tendency to draw the cords toward himself, but should work "away from himself," that is, he should keep his hands beyond the point of fixation of the suture in the tissues, thus giving the utmost freedom to the hands of the surgeon.

The motion of the two hands may be correlated in any fashion to suit the individual habit or convenience of the assistant, and it makes little difference what percentage of motion is assigned to each. Hence there are numerous possible variations of this "assistant's tie." The essential element here, as elsewhere in forming square knots, is that two exactly opposite motions be made in forming the two components. It will be found that the opposite motions, in the case of an assistant's knot, consist of carrying the free cord end through the loop of one component by means of a finger, and carrying the same free end through the loop of the second component by means of a thumb. Trial and practice show that the knot may be safely tied by the sense of touch. Automaticity and speed are favored by thinking, as the components are made, "through with a finger," then "through with a thumb," "through with a finger; through with a thumb," etc. Since the chief surgeon carries the needle holder and long end of cord to his own right side, the assistant will usually find it best to use his left hand in the manner described. However he may reverse the hands if desired.

Procedure (Figs. 24 to 30):

1. The long, or standing end, of cord is "hooked up" by means of the left index finger, palm downward.

2. A complete loop is formed over the left forefinger by a movement of the short cord end, which is held by the right hand.

3. The short end is carried over the standing end by means of the right hand and inserted through the loop by either forefinger.

4. The first component is completed by
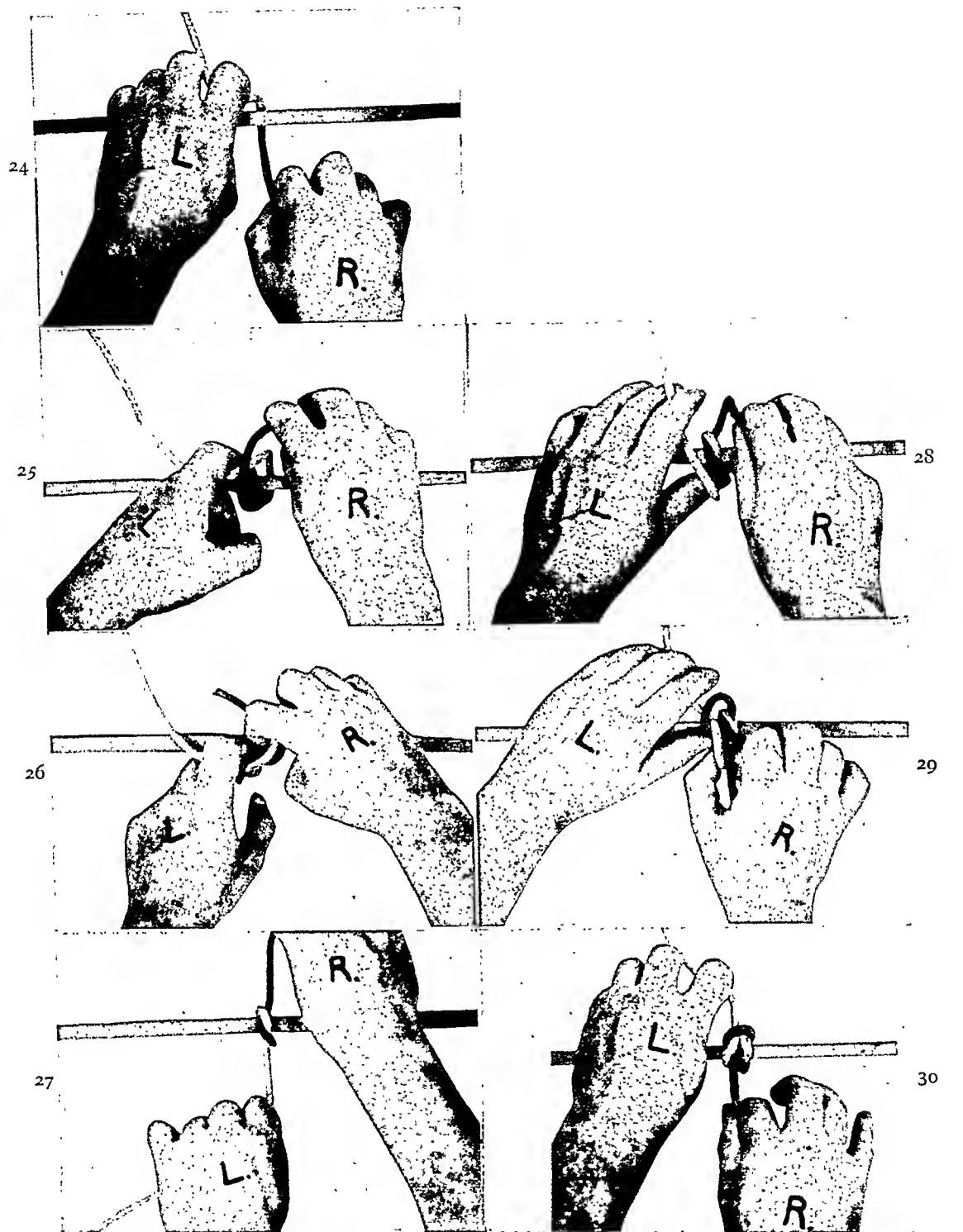
FIG. 24. The long or standing end of cord is "hooked up" by means of the left forefinger, palm downward.

FIG. 25. A complete loop is formed over the left forefinger by a movement of the short cord end, held in the right hand.

FIG. 26. The short end is carried over the standing end by means of the right hand, and inserted through the loop by either forefinger.

FIG. 27. The first component is completed by straight-line traction in the plane of the loop.

FIG. 28. Without displacing the first knot a second complete loop is formed over the left thumb.

FIG. 29. The short end is carried by the right hand over the standing end and inserted into the loop by means of either thumb.

FIG. 30. The square knot is completed by straight-line traction in the plane of the loop. The hands may be reversed for the tying if desired. See text.

straight-line traction in the plane of the loop.

5. Without displacing the first knot, a second complete loop is formed over the left thumb.

6. The short end of cord, carried by the right hand, is moved over the standing end of cord and forced through the loop by means of either thumb.

7. The square knot is completed by straight-line traction in the plane of the loop.

d. Tying the Square Knot by Means of Instruments. There are several situations in which the use of the hands alone proves inadequate. When the free end of cord to be tied is too short for digital manipulation the use of instruments makes it still possible to obtain the knot. Again, a strict aseptic technique may easily be maintained by the instrumental "no-hand-touch" method. As its name implies, this method allows the surgical work to be performed without touching with the hands either the wound itself or anything which enters the wound, such as the needle, suture, instrument tips, etc. Thus, when the instruments and supplies are sterile, emergency work may be satistorily done even though sterile gloves are not available. Some surgeons employ the instrumental tie extensively, since they feel that it is the most speedy method, the one applicable to the widest variety of circumstances, and the method most compatible with absolute asepsis.

The various instrumental ties used to secure the square knot may be looked upon as applying the principle of the special backward looping of the cord already discussed. In tying with instruments the loop of the knot is made within the standing or long end of cord. This small loop may be made either by wrapping the long end of cord once around the tip of the instrument or by a special circular motion of the instrument itself to effect the same end, namely, to create a small loop in the long end of cord with the instrument tip wrapped within. The instrument within

the loop is then made to seize the short or free end of cord and as the instrument is withdrawn the cord is pulled through the loop, completing the knot.

There are several varieties of instrumental ties. One instrument only may be used, assisted in its movements by one hand. Two instruments may be used, eliminating entirely all contact between hands and cord. Or three instruments may be used, the third being manipulated by an assistant.

The instrumental tie here illustrated is made with two implements and is formed with the plane of the loop in the operator's sagittal plane, the actual tying being done with the instrument held in the left hand, leaving the right hand implement free for other work. However, the same knot could be tied with either hand or in any plane. Procedure: (Figs. 31a to 31h)

1. While moving the long end of cord toward the point from which the short end of cord emerges from the tissues, the tip of the hemostat held in the left hand is wrapped completely around by the long cord.

2. The hemostat wrapped within the long cord is opened and made to grasp the short or free end of cord.

3. The hemostat is removed from the loop drawing after it the short end of cord and the first component is complete by straight-line traction.

4. The left hemostat is now opened leaving the short end of cord and this instrument free. Keeping the handle of the instrument at right angles to the plane of the loop and upon the same side as that from which it emerged from the first component, it is again wrapped within the long cord by a motion of the long cord made *toward* the point of emergence of the free cord end from the tissues.

5. The hemostat within the long cord is opened and made to grasp the free end of cord and to pull it through the loop.

6. Straight-line traction completes the square knot.

When it is desired to complete a square
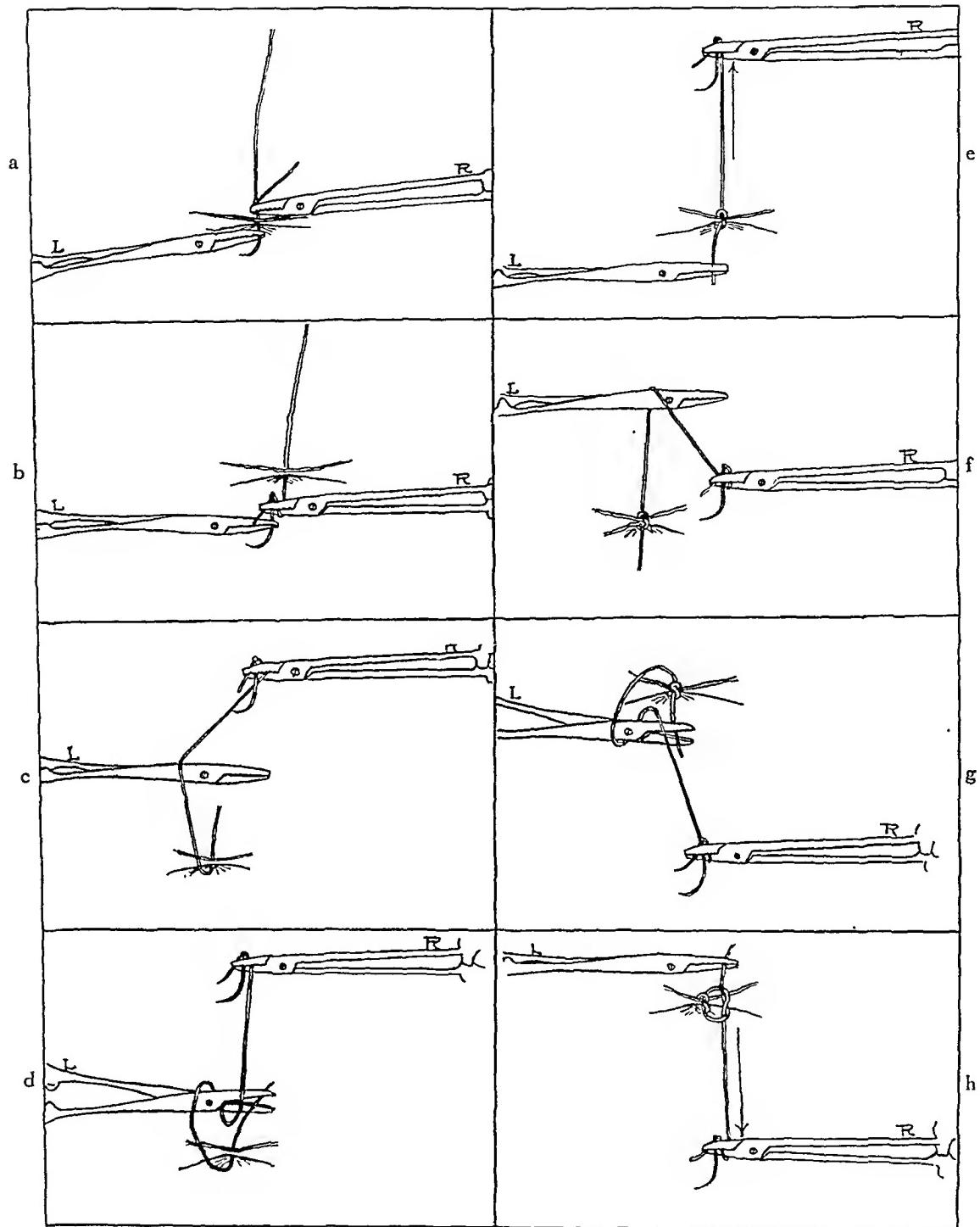
FIG. 31. (a-h). Tying the square knot by means of instruments; a two instrument method. (Note in Figure b the method of grasping the needle, to prevent unthreading of it during the process of the square knot.)

knot by means of an instrument after the first component has been tied, the following rule will be found of service:

If the handle of the free hemostat which is going to complete the knot is held at right angles to the plane of the loop of the first component, and upon the same side as that upon which the short end of cord emerges from the loop, the square knot is completed by wrapping the long end of cord about the hemostat blade with a motion of the long cord which is directed *toward* the short end. The converse is also true: if the handle of the free hemostat is found to lie upon the opposite side of the plane of the loop from that upon which the short end of cord emerges, the square knot is completed only by wrapping the long cord around the hemostat tip by a motion of the long cord which is directed *away from* the short end of the cord.

This rule makes clear the principle upon which square knots are formed in tying by means of instruments, and also explains what violations would cause the formation of granny knots.

SUMMARY AND CONCLUSIONS

1. The square, flat or reef knot is accepted as the surgical tie of choice.

2. Difficulties with the square knot are exceedingly common.

a. Fundamental rules and principles seem lacking.

b. Present methods are based upon a study of *cord* relationships and require direct vision for an examination of each knot as it is being formed, making delay necessary and error common.

c. Surgical texts frequently contain the statement that "knots cannot be taught in books" but require direct demonstration.

d. Authors commonly present one method only, which is to be used in every situation arising in routine surgical work. Thus versatility with the square knot is seldom acquired.

e. There is a total lack of standardization of this elemental and basic surgical subject.

3. There are a large number of inconstant factors or "variables" associated with the tying of knots. It is the presence of these variables that explains present difficulties.

4. The physiological method of tying knots stresses the movements of the *hands* rather than the interrelationship of the cords. This method brings the variables under control. By its use the surgeon can create square knots with the same ease and certainty with which the layman created granny knots. The physiological method is based upon two laws, which may be stated as follows:

a. Identical movements of opposite hands insure a square knot (*the law of the maneuver of ambidexterity*).

b. Opposite motions of the same hand insure a square knot (*the law of the maneuver of bimotility*).

5. Square knots can be made with safety and facility only when attention is paid to the plane in which the knot is formed.

a. To disregard the plane of the loop will result in knots which are twisted and insecure.

b. In order to copy exactly the movements for any method of tying a square knot, it is essential that the plane of the loop in the copy be identical with the plane of the loop in the demonstration.

c. Square knots may be made without the necessity for changing or crossing the hands, provided that the plane of the loop corresponds to the sagittal plane of the surgeon's body; but when the plane of the loop is parallel with the surgeon's frontal plane, the hands must always be changed or crossed as the double knot is tied.

6. Selected maneuvers are described and illustrated to demonstrate these considerations.

PREVENTION AND RELIEF OF POSTOPERATIVE COMPLICATIONS*

A SYMPOSIUM

WOUND INFECTION

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WHILE it rarely results in surgical death under modern methods wound infection is, at least, an economic disaster. It entails delayed convalescence, lengthened hospitalization and increased expense, to say nothing of the added suffering and anxiety of the patient, all of which combine to spoil the perfect service which he rightfully expects from the surgeon of his choice. Formerly we operated only to save life; later we operated to save health; now we must operate to save time. Clearly the surgeon must assume liability for the results of infections which did not exist before operation. Recent literature on this subject indicates that a large amount of experimental work is going on in our research laboratories in recognition of the importance of avoiding these costly lapses in surgical technique.

Infection arrives in surgical wounds by one of two routes: either by direct contamination from whatever the surgeon may allow to contact the wound, or indirectly by metastases through the blood stream from some distant focus within the patient. The sources of direct or extraneous infection are so well known that their discussion here is superfluous. Indirect infection occurs by metastases, mostly from the upper respiratory tract. Meyer of the Hooper Foundation says: "It is now definitely established that tetanus spores and gas gangrene producing anaerobes ingested on raw vegetables may multiply in the intestinal tract and constitute an insidious source of wound infection, which might be wrongfully blamed on instruments, sutures or dressings." Actually there are so many sources of wound infection that it is no wonder that surgeons have acquired the habit of blaming anyone or anything rather than themselves for causing the disaster. As Hugh Cabot says: "Here we see in its purest form the operation of the Doctrine of the Goat, showing our eternal desire to pin on to something or somebody the errors which we believe bring about our downfall." Cabot concludes that in his judgment the surgeon is the chief source of these infections; and Martin of Portland, after an exhaustive experimental study of the problem of disinfection for surgical procedures, concludes that the chief source in the surgeon himself lies under his fingernails. The most common, as well as the most easily overlooked source of infection is probably a punctured glove.

Along with the Doctrine of the Goat as related to wound infection, Cabot discusses what he calls the Doctrine of the Prepared Soil. In his opinion, wound infection is not so much a matter of the mere introduction of bacteria into a wound as of whether the condition of the tissues offers a soil favorable or unfavorable for the growth of the invading germs. It has been shown to every surgeon's satisfaction that perfect asepsis, in the sense of Lister, cannot be secured and, further, is not necessary. While we cannot define it exactly, we know there is such a thing as immunity or resistance to infection. Tissue resistance resides in the undamaged flesh and when a surgeon, by operative trauma,

provides food for the invading host which he himself may have introduced, he turns traitor to his trusting patient.

Surgical technique, or wound prophylaxis, is a chain with many links, and is no stronger than its weakest link; it offers protection only as every link is perfect. Perfect asepsis being as yet impossible, certain reliance must still be placed in antisepsis. Mechanical cleansing with soap or gasoline is indispensable but must be supplemented with an efficient antiseptic. Innumerable chemical antiseptics, new and old, have been recently subjected to extensive experimental study and they rise and fall like meteors on the surgical horizon. Brunner, who has spent a lifetime in the study of wound infections and their treatment, has recently declared that after trying them all he finds no better antiseptic than iodine for wound prophylaxis. Personally I am committed to the Doctrine of the Goat and the Doctrine of the Prepared Soil. I believe that most of the wound infections come from the surgeon's hand, fingernails or fist; and that the surgeon should cultivate sterile fingers and a gentle fist.

Scrupulous pains should be taken on all occasions to avoid the slightest contamination of the surgeon's hands with infectious material. Years ago Theodore Kocher said, "puddling in pus is pernicious practice." We all know how George Crile has pleaded for a velvet hand in surgery and warned against the prolonged pressure of self-retaining retractors, crushing forceps and mass ligatures, excessive suturing and strangulation stitches. The surgeon should have a profound respect for the body of his patient, conscious or unconscious, and should never take advantage of anesthesia to offer surgical insult to delicate tissues.

Next to gentleness in manipulation in my mind comes precision in the apposition of tissues in wound closure with a minimum amount of suture material of whatever kind. Absorption of large masses of catgut is certainly a physiological load on wound tissues, which may be large enough

to lower that intangible thing we call resistance. Excessive efforts to coapt wounds may strangulate the tissues and, on the other hand, the so-called dead spaces may become very much alive with bacteria thriving on retained blood or serum.

If, in spite of our prophylaxis, wound infection has occurred, the treatment should be as rational as possible. As soon as pain or temperature may indicate the onset of infection, the wound should be inspected and any tight sutures loosened, but not necessarily removed. Wide separation of the margins is rarely necessary. Small openings at selected sites will successfully evacuate retained fluids or pus without sacrificing the integrity of the closure. If incisions are necessary they may be made a short distance from the margin and thus preserve the suture line. Drains are rarely necessary and if any are used, nothing can surpass thin strips of rubber obtained from discarded gloves. Prolonged drainage with tubes results in persistent sinuses.

Irrigation of suppurating wounds is cumbersome and of very doubtful value. It has been discarded by most surgeons in the belief that the wound fluids are more valuable as healing agents than any known irrigating fluid. Not even Dakin's solution penetrates tissue to the depth occupied by the living and active bacteria. Local antiseptics may disinfect the discharges on the surface and may prevent ascending infection from without, but they add very little to the cure, except as moist dressings may encourage drainage by preventing desiccation of the discharge. The intravenous use of many antiseptics has been exploited at various times but none of them have ever retained popular favor more than a few years. The latest contribution along this line consisted of an assortment of red, yellow and green dyes, but even these have already lost favor with the profession and are now used largely for cosmetic effect.

The best way to treat an infected wound is to treat it with respect. By this

is meant the same sort of respect that was recommended for use in making the incision. Physiological rest is undoubtedly the most important single factor in the treatment of wound infection and in value probably outweighs all the others put together. At the first sign of infection the wound should be put at complete muscular rest. If near a joint this should be immobilized by splints. If on the abdomen this should be put at rest by reducing vomiting, distention or cough to a minimum, even to the extent of applying opium as the "therapeutic splint." By the same logic all manipulations and dressings should be reduced to a minimum.

The pathologists tell us that around every infection in the body the blood stream builds up a wall of defensive serum and leucocytes, which they call the pyogenic membrane. Anything which breaks down this protective mechanism allows the invading organisms to spread. The rôle of the surgeon is clearly that of withholding his hand and putting his faith in the virtue of an untrammeled blood stream.

POSTOPERATIVE RESPIRATORY COMPLICATIONS

Madison J. Keeney, m.d.

los angeles

POSTOPERATIVE respiratory infections are frequent enough to be of real importance and anything done to prevent them must be based on the causes. Statistics as to their frequency are unreliable for many reasons but in general it may be stated that one in thirty operations are followed by some type of respiratory complication and probably one in one hundred and fifty by fatal complications.

Experimental work and clinical observation have shown some of the causative factors and suggest that the anesthetic is not the deciding one in most cases. Experimental work by Lemon and others shows that aspiration of material from the mouth and pharynx occurs in almost every instance in which a general anesthetic is given unless the subject be placed in extreme Trendelenburg position. Ochsner of Milwaukee showed that lipiodol, introduced into the pharynx of patients who had peritonsillar tissue injected with novocain, was aspirated into the lower bronchial trees.

We know that postoperative infections are more common at the time of respiratory epidemics and in patients who have any such infection or oral sepsis. Statistics of all hospitals show a high incidence of lung complications after abdominal operations and especially after operations in the upper abdomen. Cutter and Hunt state that 2 per cent of all cases, 4 per cent of all abdominal and 8 per cent to 10 per cent of all upper abdomen cases develop pulmonary complications.

The high percentage of pneumonia cases following laparotomy and especially operation in the upper abdomen suggests the deciding factors acting in addition to potential infection, which is always present. Splinting of the muscles of the abdomen, interference with what Murphy referred to as the "piston action" of the diaphragm, massive or partial collapse or atelectasis of lung bases with congestion, retention of secretion and non-aeration all make favorable conditions for the growth of bacteria aspirated from the pharynx. This combination, to which is often added shock and chilling of the patient before, during or after the operation, probably explains most of the lung infections occurring the first seventy-two hours after operation.

Lung complications seen after seventy-two hours are due to embolism and infarction in the great majority of cases and embolism will explain many cases of so-called early pneumonia and pleurisy. Pulmonary embolism was the cause in 8 per cent of the postoperative deaths in the Mayo Clinic during the last five years.

While it is impossible to explain the cause of postoperative embolism and thrombosis in many cases, careful observations have thrown some light on the contributory factors at least. The average age of the Mayo series was fifty-three and the death rate in obese patients was three to four times greater than in those of normal weight. Intra-abdominal operations account for 80 per cent of the fatal cases.

The site of the thrombosis, the source of the emboli, is most often in the iliac, femoral and pelvic veins. Very few thromboses are found in the veins of the upper extremities and neck. They are also rare after operations on the breast and thyroid. The thrombosis is often found to be some distance from the site of operation; frequently a crossed thrombosis is encountered.

Primary pulmonary thrombosis occurs as does cardiac thrombosis, but these do not explain the average cases.

Stasis of the venous circulation, dehydration, shock, lowering of blood pressure and posture probably have definite influence in the production of thrombosis. Infection plays a part, though many cases of fatal embolism have occurred in clean afebrile cases in which autopsy showed no evidence of true phlebitis in the thrombosed vein.

Hutchinson of London believes that postoperative embolism is due largely to posture. He calls attention to its frequency after abdominal operations and to the fact that after such operations the patient is usually put in the position of a double inclined plane: propped up in bed with pillows under his knees. The result is a "double kink" interfering with the return flow of blood, to which is added splinting of the abdomen preventing abdominal respiration and inducing stasis.

As to abscess of the lung, interesting experimental work and arguments have appeared favoring both the embolic and the aspiration routes. Adherents of the aspiration theory of causation use as argument the common association with general anesthesia and the fact that aspiration of pharyngeal contents occurs; also that high incidence after tonsillectomy and operations on upper the respiratory tract is frequently found. Moreover, the most logical way in which infection may gain entrance to the lung is by way of the bronchial tree, especially in a patient whose reflexes are abolished by general anesthetic.

Champions of the embolic theory have a very good argument which is hard to combat. It is that postoperative abscess is extra-bronchial in type, the lesion a circumscribed nidus of infection which enlarges by destruction of adjacent parenchymatous tissue and finally ruptures into a bronchus. They call attention to the fact that it is very difficult to produce abscess by instillation of infected material, and Jackson reports that foreign bodies seldom cause typical lung abscess. Embolism is a frequent occurrence after throat operations where the field is infected. The fact is significant that improved methods of anesthesia have failed to prevent embolism.

The often delayed appearance of symptoms and the fact that lung abscess is easily produced by intravenous injections of infected materials are advanced as arguments in favor of the embolic route.

Preventive measures which suggest themselves to avoid postoperative respiratory complications are:

(1) Preoperative examination of the mouth and upper respiratory tract; (2) postponement of elective operation in the presence of infection of this area and at the time of respiratory epidemics; (3) care as to the posture of patient at time of operation and after; (4) prevention of chilling; (5) measures to combat dehydration, low blood pressure and venous stasis, (6) scientific selected anesthesia.

POSTOPERATIVE CIRCULATORY COMPLICATIONS

Robert W. Langley, M.D.

LOS ANGELES

PROBABLY the most important factor in the prevention of circulatory complications in operative cases is their recognition before the operation, and this is a very difficult matter in a great many cases. The patient on physical examination may have no gross disturbances of the heart and the blood pressure may be within the bounds of normal. The patient may have been having symptoms of circulatory disturbance for a period of years which have not been brought out in the history. The individual may be a case of hypertension, in which the blood pressure has been on a decline and has reached a normal level. The blood pressure may be within normal bounds. On careful inquiry we may find that the patient has had a history of shortness of breath on moderate exercise for some time. That is one of the most important things to know in preventing postoperative circulatory failure. Patients will go through an operation satisfactorily if this condition is known beforehand and they are properly handled. The range of anesthesia is so wide that practically all heart conditions with the exception of the bundle-branch blocks, coronary artery difficulties, etc., can go through an operation with some type of anesthesia. Even with early signs of congestive heart failure it is quite possible for them to go through an operative procedure when properly taken care of before and following the operation.

It is my opinion that in every case of obscure upper abdominal pain where the patient is forty or over, a routine electrocardiogram should be taken, certainly in any case of toxic adenoma of the thyroid where there is a question of a myocardial disturbance. If it is known that a patient has a heart condition and has had a history of attacks of heart failure in the past he should probably be digitalized before operation, in order to take care of any failure that may come on suddenly during or following the operation.

The selection of the anesthetic in a cardiac case should be left entirely to a competent anesthetist. Sometimes ethylene is indicated in cases of high blood pressure because more oxygen can be used with this gas than with nitrous oxide. The important factor in handling a cardiac case during operation is to prevent any disturbance of the circulatory balance. One cannot produce surgical anesthesia with nitrous oxide and oxygen without producing anoxemia as well. With ethylene it is possible to use from 15 to 25 per cent oxygen at all times and thus the circulatory balance is not interfered with.

It should be remembered that digitalis is not a panacea for heart failure. If a patient has been digitalized before operation he will not excrete more than 20 mm. in twenty-four hours. It is, therefore, not rational therapy to push digitalis intravenously after an operation, in a vain attempt to support a failing myocardium. With the possible exception of thyrotoxicosis when the pulse reaches or exceeds 160 beats per minute the chances for recovery are poor. Strophanthin should be used only once in twelve hours; $\frac{1}{250}$ of a grain is sufficient. Morphine should be used without regard to time, $\frac{1}{4}$ grain every three or four hours unless there is evidence of cardiac failure with spitting of blood. Adrenalin is probably not indicated except in circulatory shock and then it is of only passing value. Ephedrine hydrochloride may be used in cases of low blood pressure but its effect is only temporary. In cases of high blood pressure theobromine sodium salicylate combined with small doses of luminol every three to four hours may be of some value in keeping the blood pressure stabilized.

The removal of a pint of blood is a very good theurapeutic measure when the blood pressure shows an alarming increase.

Too much cannot be said against the promiscuous use of intravenous medication in a failing heart. The idea of loading the circulatory system with glucose solution or any other solution is certainly not a good procedure. The blood chemistry should be known and also any question about the kidneys being unable to eliminate fluids should not be left to guess work.

POSTOPERATIVE CIRCULATORY COMPLICATIONS

STANLEY GRANGER, M.D.

LOS ANGELES

WE can all remember the time, not far back, when the only examination of the heart and circulation, before an operation, was done by the anesthetist immediately preceding the operation. I think that the present better results in surgery are due, not only to better surgical methods employed, but also to greater care used in the medical examination of the patient before operation. We all know and all realize the risk in operating on a patient with evident cardiac or circulatory trouble; but it is not the type of case with evident valvular disease or myocarditis that gives us the most concern. We know now that a great many patients have certain myocardial difficulties which, at times, are not elicited by the usual means of examination of the heart and the circulatory system. This is the type of which I wish to say just a few words.

We have seen some half dozen cardiac deaths following operation. In these cases the usual heart examinations were carefully done, and showed no definite signs of trouble with the heart or circulatory system contraindicating operation. Yet these patients had a very definite damage to the myocardium, which would have been shown by an electrocardiogram. Certain types of bundle-branch lesions which in our experience have been very poor operative risks, have gone to surgery having had little attention from the cardiac standpoint, because they were without the benefit of the electrocardiograph, and it is impossible to recognize this condition without such an aid. Practically all our hospitals today are equipped with this instrument, and I am of the opinion that, in all patients over fifty years of age, in an elective operation, a cardiogram should be taken whenever there is the slightest suspicion of anything wrong with the cardiac mechanism. We know that many postoperative cardiac accidents may, in this way, be avoided; and so long as the electrocardiograph is available, I feel that this should be done as a routine procedure, particularly in prostatic operations, because often they are merely operations of election and the individual could get along, in a way, without assuming an unnecessary risk.

POSTOPERATIVE GASTROINTESTINAL ILEUS AND PERITONITIS

George Dock, m.d.

LOS ANGELES

THE internist is usually consulted regarding this postoperative complication, either because he was connected with the case from the beginning or because he is in by mistake. Sometimes an internist is called in for examination for constipation, and although one would think he would know better, he gives a cathartic. Then if the patient did not already have the ileus or a perforation or peritonitis he promptly gets it.

The points to be considered by the internist include many things. In the first place he should familiarize himself with the history of the case. Even in a plain postoperative condition the earlier history may be important. The patient may have had a severe attack of peritonitis, either from appendix or gall bladder or from some condition the history of which would suggest an obstruction later on. The next important thing is an extensive experience in seeing and handling abdomens of all kinds, healthy and diseased, and especially before operation, also being present at operation or at autopsy if the case comes to a fatal end. Another important thing is the inspection of the abdomen, thoroughly uncovered and in a good light. Sometimes we can discover the cause when we expose the abdomen.

The next thing is ascertaining the resistance of the abdominal wall, feeling on what is supposed to be the sound side first, getting a good idea of the condition and always examining with the full hand, never with the finger tips, and then using varying degrees of pressure. A change in resistance is extremely important and should never be passed by without investigation.

Another thing that we may find is local and temporary spasm in the alimentary canal. The location and character of the tenderness and pain are extremely important and they should always be obtained at the same time.

A very important sign to me is the examination of the liver dulness. Many people think the liver dulness disappears only when the abdomen becomes greatly distended, but it may disappear long before that as the result of splinting of the abdomen. The wall may be even below the level of the ribs.

Another source of error may be a high NPN, leading to a diagnosis of uremia. We see very high rates obtained, even over 100 mg. in obstruction without kidney disease. The conclusion is drawn that the patient has uremia, sweats and all sorts of things to stimulate the kidneys are given and the patient usually dies before the proper diagnosis is made.

One point of postoperative ileus not sufficiently emphasized is the value of washing out the stomach to prevent further damage. I once had the misfortune to work with a very timid surgeon and when he did not think surgery was indicated it was up to the internist to carry on and I learned the great value of that operation. One does not wait for fecal vomiting. The duodenal smell is sufficient warning and as soon as you get that the lavage should be started, using not a quart or two, but many pailfuls, if necessary, until everything comes clean.

POSTOPERATIVE GASTROINTESTINAL ILEUS AND PERITONITIS

Foster K. Collins, m.d.

LOS ANGELES

DISCUSSION

IN considering ileus, peritonitis or intestinal obstruction, we cannot discuss these conditions separately, but must take them together. The reason is that intestinal obstruction will become an ileus if allowed to continue, and with peritonitis and ileus there always is a degree of obstruction to some portion of the intestinal tract. Intestinal obstruction is either mechanical, due to some definite band, abnormal position or growth, or it is due to an ileus produced either by an infection such as peritonitis, or by some nerve dysfunction. There are two phases to consider: If the mechanical obstruction involves the circulation there will be an early ileus and a toxemia because of necrosis and destruction of the mucous membrane, permitting the toxemia to pass into the blood stream. If the circulation is not much interfered with, (an annular carcinoma or a simple band), there will not be an early toxemia because the mucous membrane is not interfered with, and protects for a longer time. These patients can be carried on a little longer if we take care to prevent dehydration and watch the chemistry of the case. Pyloric obstruction is never an emergency operation, but will cause death quickly if not cared for by lavage and measures to prevent dehydration. An obstruction of the bowel may be incomplete for some length of time, but should be regarded as an obstruction as soon as symptoms are produced. This is the favorable time to operate and as then there will be a low mortality. If the case goes on to complete obstruction the mortality will be high.

Complete intestinal obstruction always is an emergency operation and the higher the location on the small intestine the earlier it is an emergency. The question between a postoperative ileus and a mechanical obstruction is often hard to decide. If in three or four days after an operation a patient that has been doing fairly well begins to have moderate vomiting and distention the case should be looked upon as a possible obstruction, particularly if the pulse is accelerated and there is little or no temperature. The surgeon should be the one to settle the question. He should review his case and try to estimate what might be the cause of the trouble. If lavage and enema relieve the symptoms, all is well; if not, or the symptoms recur, the surgeon must operate at once for a mechanical obstruction, instituting measures for complete physiological rest if the case is an ileus. If it is a mechanical obstruction the symptoms, cramp-like pain and peristalsis that can be diagnosed best by auscultation, will be present early. This early peristalsis, when heard, is booming up to the obstructed point and a little later becomes more metallic, and in the late stages, as an ileus, becomes silent. The cramp-like pain and peristalsis will be absent in an ileus. Characteristic early vomiting is something quite important and if it comes on in the third or fourth postoperative day, the stomach should be washed and the washing sent to the laboratory. If found to contain intestinal matter, and characteristic obstructive symptoms are present, one should operate at once.

I would like to say something about enemas. No matter how good a movement is obtained from an enema, an obstruction is disproved only if the symptoms are permanently relieved. The higher the obstruction the larger the number of enemas required to get a return of fluid

free from feces and gas. If the symptoms then still exist, the case is probably an obstruction.

The time to begin to prevent postoperative ileus and peritonitis is at the time of the operation, by avoiding soiling of the abdominal contents and much handling.

The proper drainage of an abscess is of the utmost importance. Most men are draining less than formerly. If done the drainage should be ample with the drain left in for five to seven days; otherwise a residual abscess may form and there might be peritonitis and obstruction. If suspicious at all of an obstruction one should never give cathartics, and never an opiate until the diagnosis is certain.

POSTOPERATIVE ACIDOSIS AND ALKALOSIS

Roy E. Fallas, m.d., f.a.c.s.

LOS ANGELES

IN this discussion brief mention will be made of some practical applications which can be drawn for our use in acidosis and alkalosis as they arise postoperatively.

First, the fact should be taken into consideration that from the clinical manifestations alone it may be difficult and sometimes is impossible to differentiate between acidosis and alkalosis. Both are manifested by persistent vomiting, evidences of dehydration and finally coma. Dyspnea is more likely to be present in acidosis, and if tetany be present it is almost pathognomonic of alkalosis, when it accompanies persistent vomiting. However, it should be borne in mind that the only safe method of diagnosis is by complete laboratory analysis.

In alkalosis there will be found diminished blood chlorides, with increased blood nitrogen and increased CO_2 combining power of the plasma. Tetany is a late manifestation and when present is characterized by tightening of the fingers, quivering of the eyelids and tenseness of facial muscles. The fingers are flexed at the metacarpophalangeal joints; there is a quivering of the facial muscles giving rise to a characteristic grinning expression and there may be a positive Chvostek's sign. If tetany or tetanoid symptoms be present calcium is indicated and is usually given as calcium chloride, 5 c.c. of a 10 per cent solution, intravenously. If alkalosis with or without tetany be present glucose and salt are indicated and are usually given as a 10 per cent solution of glucose in normal saline. The glucose function in this condition is probably that of a diuretic in stimulating the retarded kidney elimination. The salt solution, particularly if the alkalosis complicates a high obstruction of the bowel, has a remarkable clinical effect by correcting the blood chloride deficiency. Alkalies are absolutely contraindicated in this condition and at least one death has been reported in the literature following administration of sodium bicarbonate. In this connection it should be kept in mind that the common practice of washing out the stomach with solutions of sodium bicarbonate has no place in the treatment of alkalosis.

The acetone type of acidosis is a condition in which the bicarbonate content or the alkali reserve of blood plasma is reduced. It is thought to result from the incomplete metabolism of fat with the formation of acetone, oxybutyric and diacetic acids. This incomplete metabolism of fat is thought to be due to a deficiency of the available carbohydrate or incom-

plete utilization of carbohydrate and this explains the fact that the old-fashioned methods of preparing a patient for operation, such as starvation and purgation, formed ideal conditions to promote the development of acidosis. On the contrary, of recent years patients when possible are given full diet to within twelve hours of time for operation. It has become the practice with many of us, and I understand that it is routine at the Los Angeles Children's Hospital, to augment the regular diet with frequent feedings of orange juice and cereals.

The selection and administration of the anesthetic is thought to have an important bearing on the production of acidosis. Chloroform is probably more toxic than ether; and ethylene less apt to be followed by severe acidosis than any general anesthetic at our disposal. Since suboxidation is an important factor, the care with which the anesthetic is administered is of great importance.

The most important clinical manifestations of acidosis are persistent vomiting, dyspnea, drowsiness (going on to coma unless interrupted), and acetone breath; but it must be emphasized that the clinical signs should be verified by urinalysis for acetone and diacetic before a diagnosis should be made.

The rationale of the treatment of acidosis is based on the conclusion that it is the result of incomplete metabolism of fat and secondarily that this is due to a deficiency in carbohydrates. At least it is found that administering carbohydrate in the form of glucose together with insulin acts almost as a specific in the treatment of this complication. Glucose is given in concentrations varying from 5 to 25 per cent but a solution of approximately 10 per cent is the one in most general use.

In the light of generally good results in the use of any treatment it is always easy to become complacent and omit to give proper emphasis to some of the failures. Reports of failures or serious reactions following the administration of glucose are extremely rare. In fact a careful search of the literature brought to light only one article dealing largely with unfavorable reactions. In 1926 Titus and Dodds cited reasons for these reactions and concluded that there is a basis in faulty technique for practically every unfavorably reaction. They state that the average dose of glucose should be about 1 gm. per kilogram of body weight. Less than a normal dose will often cause failure in results. As an average-sized adult weighs from 50 to 75 kilograms, the average initial dose is 75 gm.

Many reactions seem to be the result of impure glucose. None except an absolutely chemically pure product should be used. The solvent should be freshly distilled water or, when indicated, normal saline. The solution should be slowly administered. The concentration of the solution should not be a fixed one for all patients, but should be varied according to the individual needs. For example, in a patient with considerable dehydration following prolonged vomiting the opportunity should be taken to restore fluids by administering a solution of comparatively low concentration. On the other hand, in a patient with an organic circulatory impairment, bulk of fluid should be avoided by giving a more highly concentrated solution.

In this connection I should like to take the opportunity to report a case which ended fatally following glucose administration:

The patient was a woman sixty years of age, obese, with a trace of albumen and an occasional cast in the urine and with an aortic regurgitation, compensating. After one week of complete rest in bed on a diet rich in carbohydrates, she was operated upon for a large multilocular cyst of the ovary. The patient developed a paralytic ileus postoperatively with persistent vomiting. Five or six days later pulse was 88, temperature 99.6°F. several bowel movements were obtained containing traces of oil given for catharsis, and general condition was good enough to

warrant an optimistic prognosis. Because of acetone in the urine, with, however, no diacetic, she was given 1000 c.c. of a 7⁵⁄10 per cent solution of glucose intravenously with insulin. The patient had a moderate chill toward the close of the administration and this was followed by a slight temperature reaction. No other unfavorable reactions were noted. On the following day in spite of the glucose a trace of diacetic acid appeared in the urine and a second dose of 1000 c.c. of a 7⁵⁄10 per cent solution of glucose with insulin was administered. Within ten minutes after the close of the administration the patient complained of a sudden excruciating pain in the lumbar region. This pain persisted. The pulse, which had for a week been regularly 88 per minute, began quickly to climb, and the patient, within a few hours, showed unmistakable shock with a pulse

of 140, and died about thirty hours after the glucose had been administered. No autopsy could be obtained.

I do not report this case as a glucose death, but the sudden onset of severe back pain beginning ten minutes after glucose administration leading up to definite shock would make it seem probable that the intravenous glucose was responsible. It may well be that the second 1000 c.c. of fluid given in this case within twenty-four hours placed too great a strain on an already impaired heart. The thought is suggested, however, that glucose may be incompatible with the toxemia of paralytic ileus.

Two other cases of ileus in which patients have promptly died following glucose intravenously have recently come to my attention.

POSTOPERATIVE UROLOGICAL COMPLICATIONS

Robert V. Day, M.D.

LOS ANGELES

UNDER this heading no attempt will be made to go into the management of urological cases, per se, but only to discuss urological factors bearing upon the management of patients needing surgery other than urological. During the last forty years much effort has been directed toward the development of satisfactory quantitative renal function tests. A surgeon is interested principally in such tests when they show definite and measurable deficiencies in kidney function as an aid to surgical decisions and surgical judgment as well as a guide to preoperative preparation and postoperative management of surgical patients about whom there is any doubt of renal sufficiency. Such tests are classified as direct and indirect. The direct tests include the oral, intramuscular or intravenous administra-

tion of various chemicals or dyes and the subsequent determination of their promptness of appearance in the urine, the rate of their excretion and their concentration, and the total output during definite time periods of the substance injected. Ability to concentrate urea, specific gravity, the Mosenthal and other tests undoubtedly have a certain value even to the surgeon; much more to the internist. For the surgeon, however, to arrive at a practicable decision as to whether, when and under what conditions to operate, a simple, direct and fairly accurate test of measurable kidney damage is highly desirable. In phenolsulphonephthalein we have such an one, and it is as reliable a procedure as any in medicine or surgery, not excepting the Wassermann test. Even when done properly, however, its answer is not

infallible. For instance, as occasionally occurs, a patient with a perfectly normal output of dye previous to operation will develop an anuria and die in from one to several days following the operation. In such cases other factors are present, usually discoverable beforehand with the aid of a capable internist. These are cardiovascular disease, more or less latent in its manifestations, too much surgery at one time, excessive surgical shock, hemorrhage, etc., obviously attended with deficiency of the cardiac muscle, lowered blood pressure and often fluid depletion. Conversely, in an occasional instance, the patient, almost without function as determined by the dye test, survives a serious operation. Probably, like insurance companies, we should in most instances be concerned with the law of averages and not primarily the exceptional case. There seems to be a prevalent notion that if total, non-protein nitrogen, urea nitrogen or creatinin of the blood are within normal limits, a good kidney function is assured. This is a wholly erroneous assumption and both kidneys must be severely damaged and the function enormously lowered before the non-protein nitrogen elements of the urine begin to show retention in the blood. At least 80 per cent of prostatics showing marked diminution of kidney function fail to show any evidence of nitrogen retention in the blood.

Too little emphasis has been given the technique of the kidney functional test with 'phthalein. It is amazing to note the number of gross errors of everyday occurrence. These errors are, in a vast majority of instances, due to faulty collection of urine to be examined quantatively for dye content. Faulty collection results when the patient or nurse fails to deliver to the laboratory the total amount voided, or as *more* often occurs, the patient fails to empty the bladder completely. This incomplete emptying happens quite often with patients whose entire genitourinary system is quite normal, and yet when a complete emptying of the bladder is most desired they have a stage fright and fail to accomplish it. Therefore, if a 'phthalein is definitely below normal and the clinical picture as a whole does not conform with it, the 'phthalein should be collected by the catheter method, being careful to rinse the bladder with distilled water and to add the rinsings to the sample intended for the dye determination in the laboratory.

When should the general surgeon require a preoperative functional test? Theoretically, perhaps in every case of elective major surgery, as is required in some hospitals, notably the Peter Bent Brigham and the Barnes Hospital. Practically, if there is a history of urinary disease, if the urine shows abnormalities such as blood, pus, albumin, or casts, or there is undue polyuria, frequency, difficulty or dysuria, then a kidney functional test is clearly indicated. If the patient is a male and over fifty years of age, he should be catheterized for residual urine, and if that is present, kidney function should be determined. Hernias and hemorrhoids of recent occurrence in the male patients over fifty years of age should be suspected of bladder-neck contracture or hypertrophy until proved otherwise. In elective surgery abnormalities of the urine or urinary act should be adequately studied and classified before surgical operations are done unless there is an emergency or other legitimate reason for haste. The amount of urological study necessary to determine this may be little or much, depending on the individual case. With normal urine and a normal urinary act, with no history of previous urinary disease, in the average surgical patient except the prostatic, the urinary function may be assumed to be normal and the danger of postoperative anuria or insufficiency practically nil, provided that the presence has been excluded of cardiovascular or other grave disease affecting actively or potentially the bodily functions in a general way. In a sentence, elective surgery should be preceded by a complete diagnosis by whomsoever is best fitted to accomplish

this. Cardiovascular disease, even latent, when clinical and laboratory examinations indicate normal or at least fair kidney condition, is frequently followed postoperatively by renal insufficiency. One wonders if this is not often an acute cardiac dilatation. Clinical experience seems the best guide under such circumstances.

CATHETER CYSTITIS A MISNOMER

Usually the nurse or interne is blamed for the occurrence of urinary infection following surgical operations when, as a matter of fact, the surgeon in charge is responsible. So often one is told that after a few catheterizations the patient began to void and the use of the catheter was discontinued; still, fever and other symptoms continued and the urine was loaded with pus. The patient was in effect simply voiding the overflow with a big residual left behind. Infection follows catheterization of a healthy bladder only when that bladder is not emptied soon enough, often enough and for a long enough period. The greatest factor in the production of any infection of the upper urinary tract (including the bladder), is distention or back pressure, frequently a superimposed latent infection. Distention brings about a "prepared soil," following which some degree of infection is pretty sure to occur notwithstanding the most rigid aseptic catheter technique. Conversely, the intentional introduction of pyogenic organisms into the bladder of man or animals does not produce infection, even in the presence of considerable trauma, if no pathologic condition, active or latent, exists in the urinary tract, and there is no distention or residual urine. Hugh Cabot, in a paper entitled "Prepared soil,"[1] discusses this problem at some length and, on both experimental and clinical data observed by himself and others, believes that postoperatively a patient should not be allowed to accumulate more than 10 oz. (300 c.c.) in the bladder. He instructs his nursing

staff to catheterize the patient at any time after the twelfth postoperative hour if their observations lead them to believe that this amount has been reached, their conclusions being based on the patient's own sensations. Curtis[2] believes that distress should be the signal for catheterization. It occasionally happens, however, that a considerably distended bladder gives little or no distress, or any distress felt is referred to other organs or regions. Better twice as many catheterizations as necessary than 20 per cent too few. If a patient after operation has persistent difficulty in urination and requires prolonged catheterization or fails to empty the bladder, an indwelling catheter should be used.

In the female a 22 Pezzer, self-retaining catheter is inserted after the following method: A uterine sound with an especially large and rounded point is inserted through the eye of a Pezzer catheter on into the hollow end and the rubber stretched, the right thumb and forefinger holding it alongside the sound. This for the moment straightens out the button end and allows it to pass more easily through the urethra into the bladder. The operator, if righthanded, should stand on the right side of the bed and, after generous use of a water-soluble lubricating jelly, the thumb and fingers of his left hand should separate the labia, exposing the vestibule with the urethra in the center, and the catheter should then be pushed on into the bladder. The thumb and fingers of the right hand are then relaxed, allowing the end of the catheter to resume its button shape, after which the sound is carefully dislodged and removed. One now injects the syringe full of water or other solution into the bladder, and, if there is a good return flow, the patency of the catheter is established. Slight traction should be made on the catheter until one's tactile sense shows that the button end has impinged on the bladder neck. It is then pushed into the bladder an

[1] Cabot, Hugh. Doctrine of the prepared soil. *Canad. M. Assn. J.*, 11: 610, 1921.

[2] Curtis, A. H. Management of the female urinary bladder after operation and during pregnancy. *J. A. M. A.*, 80: 1126, 1923.

additional half inch and a good-sized glass connecting tube, with the two ends of the *same* caliber, inserted in the outer end to weigh it down. In a male urinal one should cut off the catheter before inserting the glass connecting tube, so that excessive length will not cause it to bend or kink. The catheter need *not* be strapped or tied in and will be self-retaining provided it is not connected with a heavy rubber tube emptying into the bottle alongside of the bed. If a female urinal is used, it is much more easily upset. Even urine in the bed is preferable to bladder stasis or distention.

In the male a soft rubber or Coude catheter answers best. (A Pezzer catheter should never be forced through the male urethra because of the trauma it produces.) When so-called urethral fever or a chill follows urethral instrumentation, four times out of five it means active or latent pyelonephritis, very often calculus, at most other times latent infection in the seminal vesicles or prostate. If catheterization is harmless in the absence of a urinary pathologic condition, but not infrequently gives severe reactions when disease is present in the urologic tract, withholding the use of a catheter through fear of infection parallels the foolishness of the ostrich with its head buried in the sand. If there is present a pathologic condition, latent or active, one should know it in order better to combat it.

COMPRESSION MYELITIS*

WILLIAM A. SMITH, M.D. AND CHARLES E. DOWMAN, M.D.

ATLANTA

WE have selected for presentation 6 cases illustrating different types of neoplasms causing compression myelitis. Before showing these cases we wish to make a few remarks on the causes and diagnosis of compression of the spinal cord.

Any lesion encroaching on the spinal canal may cause compression myelitis. These lesions may be divided into (1) extraspinal diseases, (2) lesions of the spinal column, (3) lesions within the spinal canal. Extraspinal diseases which may produce pressure on the spinal cord are: an aneurysm which erodes the vertebrae, and an extraspinal tumor which invades the spinal canal through direct extension. Among the spinal diseases may be mentioned tuberculosis, which, by the formation of an abscess, a chronic pachymeningitis, or an extreme spinal deformity, may cause compression of the cord; primary and secondary neoplasms of the spine; arthritis deformans, and extreme scoliosis; an acute osteomyelitis with the formation of an epidural abscess; fracture dislocations of the spine, etc. Within the spinal canal the epidural space may be the site of a tumor, of an acute abscess, or of a mass of chronic inflammatory tissue. Occasionally the epidural space may be the site of a growth of lymphoid tissue in Hodgkin's disease and the leukemias. Within the dura the most common cause of compression is a tumor or cyst which may arise from the meninges, the nerve roots, or the cord itself.

Compression of the spinal cord may simulate clinically many of the degenerative and inflammatory diseases of the cord. Fortunately, with the use of modern methods, the diagnosis may be made correctly in most instances. Failure to use the methods may allow cases to go unrecog-

nized for a long period of time. An early diagnosis is all-important. While it is true that a compression may exist for one or more years and recovery still be possible on removal of the compression, there is always the danger that a vessel may become occluded, with a resulting softening within the cord and permanent disability.

DIAGNOSTIC FEATURES OF CORD COMPRESSION

1. THE HISTORY. The first symptom as a rule is pain. The pain is of a severe, sharp, and rapidly intermittent type; it radiates along the distribution of a nerve root, as down an extremity, or from the spine anteriorly around the trunk. It is characteristically aggravated or produced by straining, such as coughing, sneezing, and straining at stool. The consideration of a spinal cord compression in any case of sciatica, neuralgia, or thoracic or abdominal pain, not readily explained on another basis, cannot be too strongly emphasized. Pain is sometimes absent, even though a tumor may directly involve a nerve root. When present it is of great value in localizing the level of the compression. This type of pain is absent in most of the degenerative and inflammatory diseases of the cord, such as combined sclerosis or multiple sclerosis. In spinal syphilis pains may occur, but when present are usually widely distributed and not confined to one or two root segments. The anterior roots may also be compressed, leading to weakness, intermittent spasms, or muscle atrophy in the region involved. As the compression increases signs of disorder in the long pathways of the cord appear, resulting in motor weakness and sensory disturbances below the level of the compression. These symptoms may come on gradually, producing the so-called Brown-

* Read at a pre-assembly clinic of the Interstate Post-Graduate Medical Association of North America, October 12 to 19, 1928, Atlanta, Georgia.

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Sequard syndrome, with weakness and deep sensory changes on the one side, and an anesthesia for pain and temperature the disturbance in the sympathetic innervation of the eyes in compression at the upper dorsal region. The dissociation of

FIG. 1. Roentgenogram of aortic aneurysm causing compression myelitis.

FIG. 2. Metastatic carcinoma of the spine (ivory type) causing compression myelitis.

sense on the other. More frequently, however, symptoms occur on both sides simultaneously, and gradually lead to a complete motor and sensory paralysis below the compression. Disturbance of the urinary and rectal sphincters may occur with compression at any level, but these disturbances appear earlier and are more severe in cases where the sacral segments are compressed. In general, the history will show the development of a disease of the cord, progressing in a horizontal direction at a particular cord segment.

2. THE NEUROLOGICAL EXAMINATION. This may show evidence of involvement of the anterior roots at a particular level, such as muscular atrophy or spasms. Involvement of a sensory root may produce an upper area of hyperesthesia. Above the level the findings are normal; below this level there are signs of motor and sensory, and vasomotor and pilomotor disturbances. With compression at certain levels, special signs are produced, such as

sensation, as in syringomyelia, may occur with compression. The sensory changes are valuable in localizing the level of the compression, although occasionally they do not reach as high as the level involved. Great care must be used and repeated examinations must be made in interpreting these sensory changes.

3. THE ROENTGEN-RAY EXAMINATION. This is of value in those cases where the compression is due to some disease of the vertebra. Figure 1 shows a roentgenogram in a case of abdominal aneurysm which has eroded the vertebra. This patient had had sharp pains in the loins for eighteen months, pains in the legs for one year, and weakness in the legs which had progressed to paralysis. For two weeks, he had had urinary retention. The examination disclosed a motor and sensory paralysis below the level of the 11th dorsal segment, with muscular atrophy and loss of reflexes. There was evidence of a spinal block on the jugular compression test. Figure 2

shows a metastatic carcinoma of the spine, involving the bodies of the 5th and 6th dorsal vertebrae; there is an increased

the legs which progressed to a complete paralysis. There was incontinence of urine; there was anesthesia up to the nipple line.

Fig. 3. Metastatic carcinoma of the spine (destructive type) causing compression myelitis.
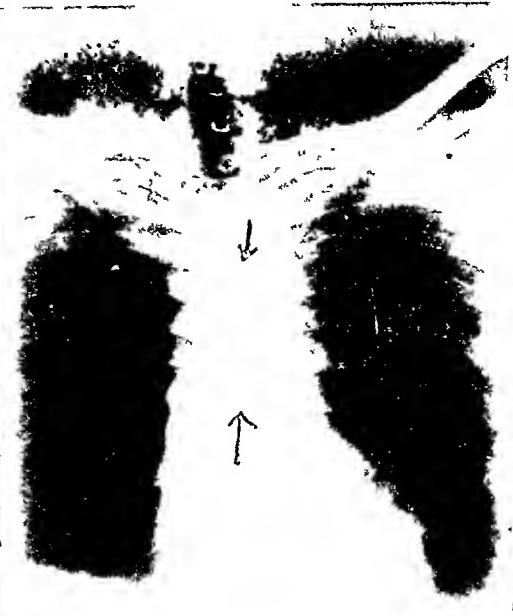
Fig. 4. Tuberculosis of the spine causing compression myelitis.

density of these bones without evidence of destruction; this is the so-called ivory spine, or ivory type of carcinoma. The primary tumor was in the prostate. The patient had complained of pains along the lower ribs for ten months, followed by burning sensations in the legs, and finally a complete paralysis. There was a complete motor and sensory paralysis below the level of the 7th rib, with increased tendon reflexes and a bilateral Babinski reflex. The spinal fluid was yellowish and the pressure readings showed a complete block of the spinal canal. Figure 3 shows a metastatic carcinoma of the spine of destructive type. This patient had had a carcinoma of the breast removed, and had been apparently well for fifteen years. She then developed a progressive motor and sensory paralysis, and other evidence of spinal cord compression. Figure 4 shows a case of spinal tuberculosis. This patient had had for nine months a numbness of the lower extremities and a weakness in

The spinal fluid was yellowish and the jugular compression test showed a complete spinal block.

4. The Spinal Fluid. The first finding in cord compression is an increase in the globulin content, without a rise in the cell count. This is a valuable point in the differentiation of syphilis and other inflammatory diseases from cord compression. The rise in globulin continues until it becomes extremely high; the cell count remains normal. A comparative study of the fluid removed from above and from below the site of compression shows the globulin content to be much higher in the fluid below the compression. Later the fluid becomes yellowish from transudation from the blood vessels, and tends to coagulate en masse, soon after removal. This is a late stage, and the diagnosis should be made before the spinal fluid is of this type.

5. The Queckenstedt Test. This is the greatest single means of diagnosing

a spinal cord compression. It should be done as routine with every spinal puncture. This test shows whether there is free circulation of cerebrospinal fluid or whether there is a block in the spinal canal. There is normally a free communication between the ventricles of the brain and cerebral subarachnoid spaces and the spinal subarachnoid space. If the internal jugular veins are compressed there results a venous congestion of the brain. This in turn causes an increase of intracranial pressure and a forcing down into the spinal canal of an increased amount of subarachnoid fluid. The Queckenstedt test is based on these fundamental principles. The test is performed as follows: With the patient lying on the side a lumbar puncture is done and the spinal fluid pressure measured by means of a glass tube 0.5 cm. in diameter and about 30 cm. long. The height of the fluid in the tube is read off in millimeters. (All coughing and straining on the part of the patient should be avoided as this will cause a congestion of the spinal veins and a rise of the pressure even in the presence of a block.) The jugular veins are now compressed. Under normal circumstances there will occur immediately a prompt rise of the fluid in the tube, and a prompt fall to the original level on the release of the jugular compression. If there be a complete block in the spinal canal, a rise in the spinal pressure will not occur. If there be a partial block the spinal fluid pressure will rise slowly and in a step-like manner, and on release of the jugular compression there will be a step-like fall down to a level which is much higher than the original level.

6. The Intraspinal Injection of Substances to Cast a Shadow on the Roentgen-ray Film. One may inject air by the lumbar route, or iodized oil by the lumbar or cisternal route. The roentgenogram will then visualize the ascent or descent of the substance used, and if there is a spinal compression sufficient to block this, will reveal the level of the lesion. This is of value in only a small number of cases;

in most instances, the neurological examination, history and Queckenstedt test are sufficient for diagnosis and localization. These means are essential in diagnosis.

There is one condition which we would like to discuss separately, as it so closely simulates a spinal cord tumor. The history and neurological findings may be identical, and there may be evidence of a block on Queckenstedt test. This condition is an inflammatory condition of the meninges, with the formation of delicate adhesions between the pia and arachnoid: an adhesive arachnoiditis. In this condition, the development of symptoms is likely to be much slower. The spinal fluid does not become yellowish even though a complete block exists. One cannot always differentiate this condition from a cord compression. The actual differentiation is made at operation.

Before reporting cases of spinal neoplasm we wish to discuss briefly the indications for laminectomy in spinal injuries and in tuberculosis of the spine with evidence of cord compression.

In spinal injuries with evidence of cord involvement, one may be at a loss to know whether or not a laminectomy should be done. The only indication for laminectomy in such cases is the necessity of removing pressure on the cord. The pressure may be caused by bone fragments, an extreme angulation, blood clots or edema. The degree of paralysis is no evidence of compression. It is in such cases that the Queckenstedt test is particularly valuable. This was first emphasized several years ago by Coleman of Richmond. In our own clinic the Queckenstedt test is done as routine on all cases of spinal injury. If there is evidence of spinal block a laminectomy is done immediately. If no block is present such an operation is not done. The test should be done every day, as a block from edema may develop. Under such circumstances the operation is indicated.

In those cases of tuberculosis of the spine which develop symptoms and find-

ings of a progressive paraplegia, the Queckenstedt test again gives most valuable information. Should a block develop, the compression should be relieved by a properly performed laminectomy. A bilateral laminectomy should not be done in such cases on account of the necessity of having a sufficient support in the presence of diseased vertebral bodies. A unilateral laminectomy combined with a spine fusion or bone graft on the opposite side will give the compressed cord sufficient room without weakening the spinal support. The dura should never be opened in such cases on account of the danger of producing a tubercular meningitis. We have had several very spectacular results by treating cases of this type in this manner.

CASE REPORTS

Case 1 is an illustration of compression myelitis from a tumor of the spinal vertebrae.

CASE 1. H. G. L., a male, aged forty-three years, was first seen on February 7, 1928.

HISTORY. *Pain* had been present since February, 1926 (two years). This was a throbbing pain in the lower abdomen radiating from the spine around the right side toward the midline, but never extending beyond the midline. In November, 1927 the appendix was removed, but this gave no relief from pain. Two weeks after operation the patient was seized with similar pain in the left side, just above the crest of the ilium and radiating down the posterior aspect of the left thigh. *Paresthesias* had been present for four months. These consisted of burning sensations in the feet and legs (below the knees) alternating with a sensation of coldness, reaching up to the iliac crests. *Numbness* in the legs had been present for three months. *Weakness* of the legs had been present for three months, rapidly progressing to a complete flaccid paralysis of the lower extremities. There had been no sphincter disturbance. The history was otherwise unimportant.

EXAMINATION. *The neurological examination* showed a complete flaccid paralysis of the lower extremities, with impairment of touch, pain and temperature senses up to the 12th dorsal segment (Fig. 5). Joint sense was lost in

the toes of both sides. Vibratory sense was lost in the lower extremities. The tendon reflexes in the lower extremities were not obtained.
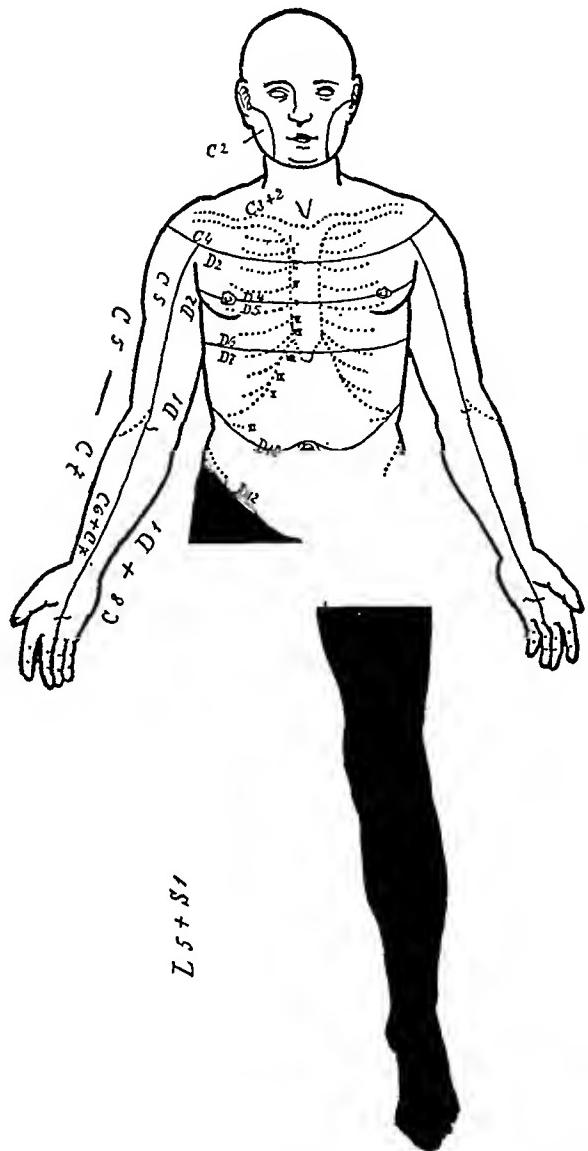
FIG. 5. Case 1. Chart showing sensory disturbances. Flaccid paralysis of legs with loss of tendon reflexes. Bilateral Babinski reflex. Loss of abdominal (lower) and cremasteric reflexes. Loss of joint sense in toes. ▮▮ Impaired touch, pain and temperature senses.

There was a bilateral ankle clonus. The lower abdominal and cremasteric reflexes were lost on both sides. The other findings were normal.

The *spinal fluid* was clear and yellowish in color; the initial pressure was rather low, 60 mm. water. On jugular compression the pressure very gradually rose to 130 mm. water; on release of compression the pressure remained stationary, dropping only 20 mm. after two

minutes. The fluid contained 5 cells per cu. mm. and showed an increased globulin content.

The roentgenogram of the spine showed a
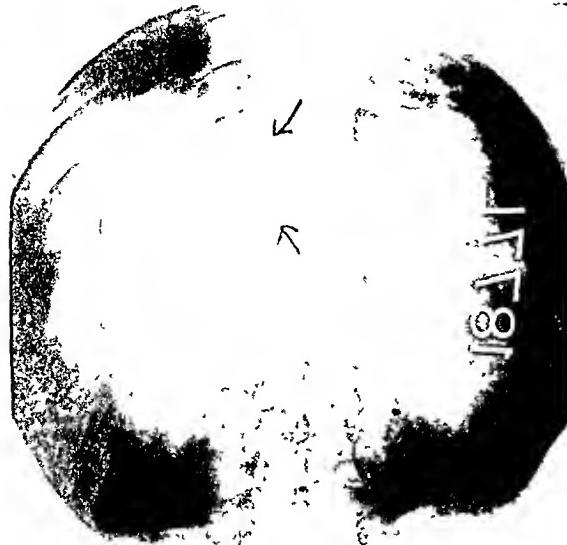
Fig. 6. Case 1. Roentgenogram of spine.

tumor mass involving the body of the 12th thoracic vertebra, and extending outward to the right (Fig. 6). Physical and laboratory examinations revealed no other abnormalities.

DIAGNOSIS. Malignancy of the spine, probably bone sarcoma.

TREATMENT. The patient was given three series of deep roentgen-ray treatment. Within twenty-four hours after the first treatment he had relief from pain. After four treatments (one month) he began to regain ability to move his feet. At that time (March 12, 1928) the spinal fluid had lost its yellowish color. Pressure readings showed a much more rapid rise in pressure on jugular compression, with also a more rapid fall on release of compression. Improvement steadily advanced, the patient's weakness and sensory disturbance in the legs completely disappearing. He was kept in bed for eight months. On May 9, 1928 the spinal fluid was clear and colorless and on the Queekenstedt test there was no evidence of any spinal block. He is now free of pain and has no complaints.

COMMENT. In this case, pain was the sole symptom for twenty months; the character and location of this pain were typical of a posterior root irritation. The appendix was removed for the pain. The frequency of such abdominal operations in cases of compression myelitis is very high; it would seem that the nervous system is deserving of more consideration by abdominal surgeons in cases of obscure abdominal pain. A roentgenogram of the spine in this case would have located the pathology. The patient was complaining of paresthesias in the lower extremities before this operation. This recovery on deep roentgen-ray treatment has been very gratifying. Symptomatic recovery, with disappearance of all evidence of spinal block and other clinical signs, was hardly expected.

CASE II. R. P., a male, aged thirty-two years, was first seen on September 16, 1928.

HISTORY. *Pain* had been present for seven months, located at first in the lumbar spine, and produced by a change in position. It lasted but a few moments; it gradually extended to the perineum, and into the posterior aspect of the right thigh. For two weeks the pain had been most severe in the region of the coccyx. It was aggravated by change of position, straining and coughing. *Numbness* had been present for three months, in the posterior aspect of the right thigh. *Bladder and rectal incontinence* had been present for two weeks, particularly on straining and coughing. The history was otherwise unimportant.

EXAMINATION. *The neurological examination* showed an impairment of all forms of sensation in the sacral region, corresponding to the 3rd, 4th and 5th sacral segments (Fig. 7). The findings were otherwise entirely normal except for a relaxed anal sphincter with loss of the anal reflex.

The *spinal fluid* was clear and colorless; the initial pressure was 170 mm. water. Jugular compression tests gave normal findings. The spinal fluid contained 3 cells per cu. mm. and a marked increase in globulins. The mastic curve was 42,500. All other clinical and laboratory findings were normal.

DIAGNOSIS. The findings of a localized progressive lesion and the characteristic spinal fluid findings strongly suggest a neoplasm of the lower portion of the cauda equina. The normal Queekenstedt test was due to the fact that the lesion was probably below the site of spinal puncture.

OPERATION. Operation revealed an extradural tumor within the sacral canal anterior to the cauda equina, 1½ cm. in diameter, located at the level of the emergence of the 3rd sacral roots from the sacral canal. The

roots were pushed backward by the tumor mass. The tumor was removed.

PATHOLOGICAL EXAMINATION (Dr. E. L.
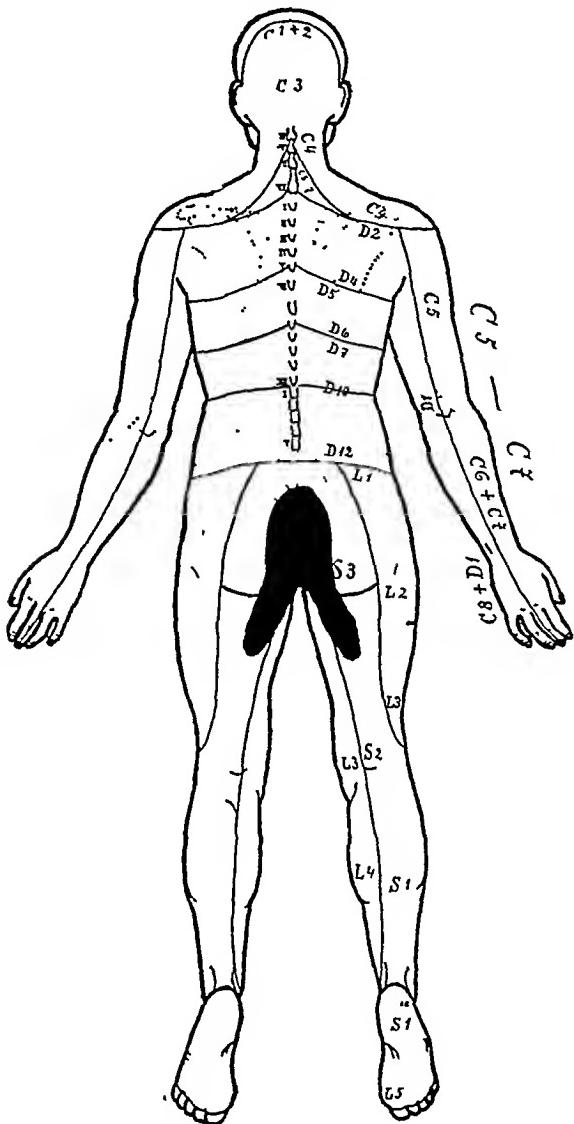
FIG. 7. Case II. Chart showing sensory disturbances Urinary and rectal incontinence. Relaxed anal sphincter. ▮▮ Impaired touch, and pain senses.

Bishop). Histological examination showed the tumor to be a chondroma (Fig. 8).

COURSE. The pains have disappeared and the sacral anesthesia has receded to an area around the anus about 4 cm. in diameter. Control of the bladder and rectal sphincters has improved, but is not yet complete.

COMMENT. This is an example of an extradural neoplasm of a rather rare type. Stookey has recently reported 7 cases of ventral extradural chondroma in all of which the tumor was located in the cervical region.

CASE III. J. E. O., a female, aged twenty-four years, was first seen on December 6, 1927.

HISTORY. Weakness in the legs had been

FIG. 8. Case II. Microphotograph of tumor (chondroma).

present for sixteen months; it had progressed so that complete paralysis of the lower extremities had been present for fifteen months. Numbness had been present for fifteen months. It began in the right foot and gradually ascended, later involving also the left foot. This numbness within one month had spread over both lower extremities and the trunk up to level of the breasts. Bladder and rectal disturbance had been present for fourteen months, with both urinary and rectal incontinence. Backache in the lumbar region had been present for fourteen months. There had been no sharp pains. History was otherwise unimportant.

EXAMINATION. The neurological examination showed a complete spastic paralysis of the lower extremities. There was marked impairment of touch, pain, temperature and vibratory senses up to the border of the 6th rib (Fig. 9). Joint sense was lost in the toes. The tendon reflexes in the lower extremities were highly exaggerated and there was a bilateral Babinski reflex and a Schaeffer reflex. There was an unsustained ankle and patellar clonus on each side. All abdominal reflexes were lost.

The spinal fluid was clear and colorless. On jugular compression test, a complete spinal block was found. The fluid contained a large amount of globulins, the cell count was 5 per cu. mm. Other clinical and laboratory examinations gave normal findings.

DIAGNOSIS. Spinal cord tumor, located at the 5th or 6th dorsal segment.

OPERATION. Laminectomy revealed an

FIG. 9. Case III. Chart showing sensory disturbances. Spastic paralysis of legs. Increased tendon reflexes in legs, with bilateral Babinski reflex. Loss of abdominal reflexes. Loss of joint sense in toes. Bilateral patellar and ankle clonus. ■■■ Impaired touch, pain, temperature and vibratory senses.

intradural tumor at the level of the 6th dorsal segment. It was attached to the dura posteriorly, and this portion of the dura was removed with the tumor, leaving a slight depression in the cord. The tumor measured 1.75 cm. by 1 cm. (Fig. 10).

HISTOLOGICAL EXAMINATION (Dr. E. L. Bishop). On microscopical study, the tumor was seen to be an endothelioma. The structure

was made up of spindle cells, with areas whorl formation with endothelial pearls (Fig. 11).

FIG. 10. Case III. Photograph of tumor.

COURSE. The patient made a rapid recovery. She now has no evidence of any neurological disorders on examination, and is free of all symptoms.

COMMENT. This is an example of a painless spinal cord tumor, intradural but extramedullary in location. The absence of pain does not
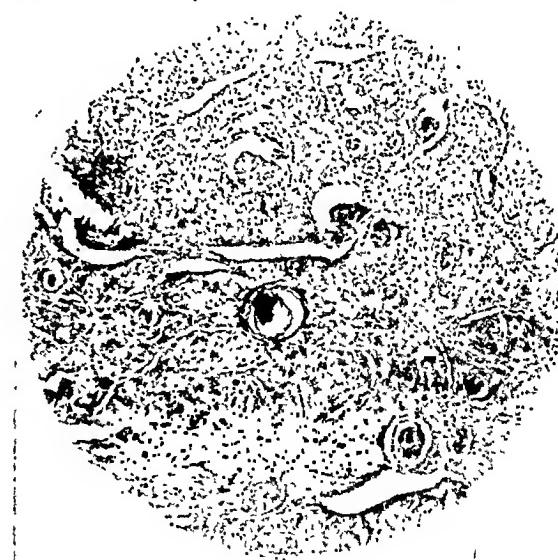
FIG. 11. Case III. Microphotograph of tumor (endothelioma).

exclude the possibility of a spinal cord neoplasm. Complete recovery was obtained in this case, in spite of the fact that paralysis had been present for fifteen months.

CASE IV. H. N., a boy, aged fourteen years, was first seen on January 12, 1928.

HISTORY. *Weakness in the legs* had been present for four months, beginning with a tendency to stump his toes. It had gradually progressed so that there had been complete paralysis of the legs for one month. *Slight numbness* had been present in the legs for

several weeks. He has had no other symptoms. The history was otherwise unimportant.

EXAMINATION.   The *neurological examination*

FIG. 12. Case IV. Chart showing sensory disturbances. Spastic paralysis of legs. Loss of abdominal and cremasteric reflexes. Increased tendon reflexes in legs. Bilateral Babinski reflex. Loss of joint sense in toes. ▓ Impaired touch, pain, temperature and vibratory senses.

showed a complete spastic paralysis of the lower extremities. There was loss of the abdominal and cremasteric reflexes on both sides. The tendon reflexes in the lower extremities were highly exaggerated. There was bilateral Babinski reflex, and a bilateral ankle and patellar clonus. There was an impairment of touch, pain and temperature sense up to the costal

margin. Vibratory sense was diminished over the bony prominences up to the iliac spines. Joint sense was lost in the toes (Fig. 12).

FIG. 13. Case IV. Photograph of tumor.

The *spinal fluid* was clear and colorless, under 40 mm. water pressure. With prolonged jugular compression the pressure rose to 160 mm. where it remained, and did not fall on release of compression. There was marked increase in globulin content of the spinal fluid. Other examinations gave normal findings.
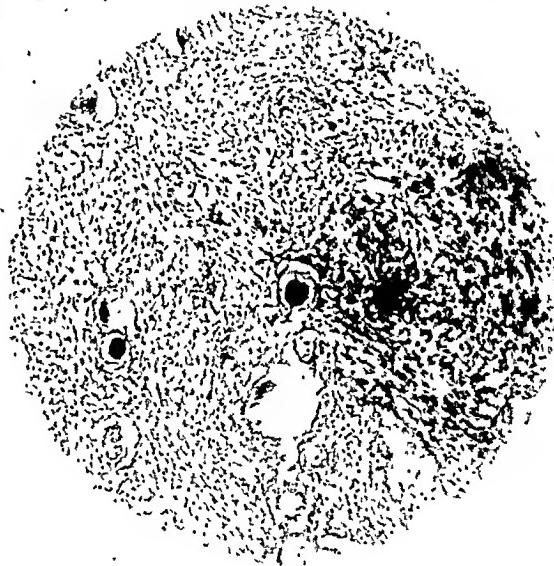
FIG. 14. Case IV. Microphotograph of tumor (endothelioma).

DIAGNOSIS.   Neoplasm of the spinal cord in the mid-dorsal region.

OPERATION.   Laminectomy revealed a tumor at the level of the 6th dorsal segment. It was intradural, and attached to the posterior portion of the dura, to the right of the midline (Fig. 13). This portion of the dura was removed with the tumor. A posterior nerve root on the right side was attached to the tumor and had to be severed in order to remove the tumor.

COURSE.   The patient made a perfect recovery. He is now free of symptoms and has no objective neurological disorders.

HISTOLOGICAL EXAMINATION (Dr. E. L. Bishop). Microscopical study of the tumor showed it to be an endothelioma (Fig. 14).
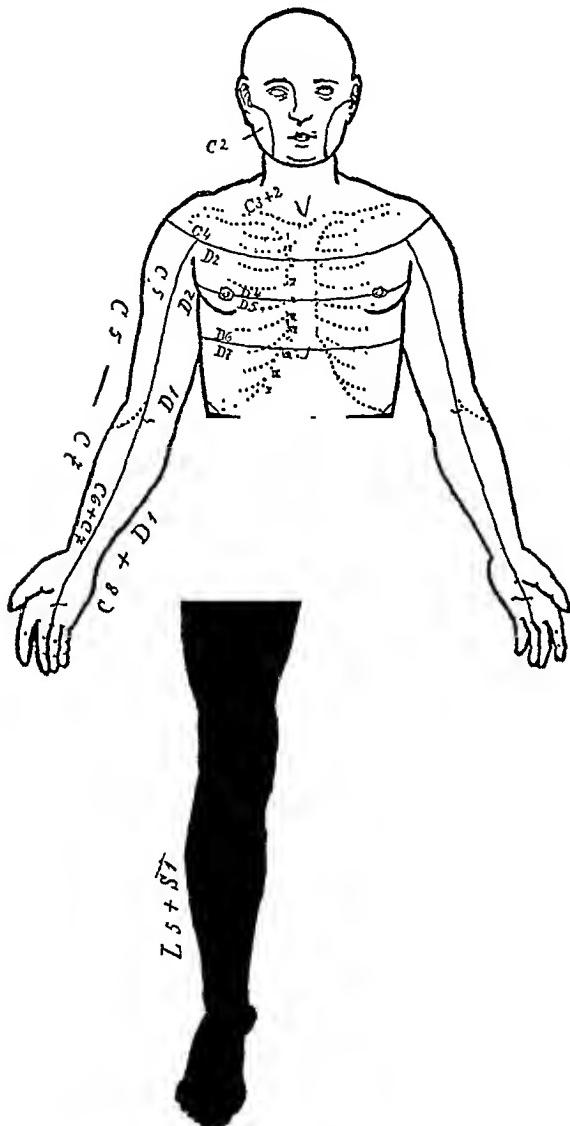
FIG. 15. Case v. Chart showing sensory disturbances. Slight weakness in flexors of legs. Loss of lower and middle abdominal, and cremasteric reflexes. ■■ Impaired touch, pain, temperature and vibratory senses.

COMMENT. This is another example of intradural but extramedullary spinal cord neoplasm in which pain was absent, even though the tumor directly involved a posterior nerve root. The recovery was also complete in this case. The tumor was a meningioma, a type of tumor which is the most common of spinal neoplasms, in which operation gives excellent results.

CASE V. H. F. K., a male, aged forty years, was first seen on September 4, 1928.

HISTORY. *Pain* had been present for three

FIG. 16. Case v. Photograph of tumor.

years, sharp and shooting in character, radiating around the waist at the level of the umbilicus on the right side. The pain was very severe on any jarring of the body. The appendix and gall bladder had been removed without relief. *Slight weakness in the legs* had been present for six months. *Numbness* in the right
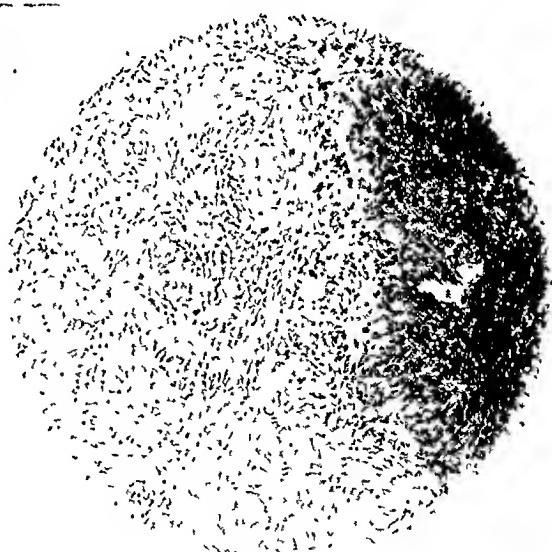
FIG. 17. Case v. Microphotograph of tumor. (Neurofibroma.)

foot had been present for six months. It had been noticed more recently also in the right thigh. *Slight difficulty in urination* had been present for four months. The history was otherwise unimportant.

EXAMINATION. The *neurological examination* showed slight weakness in the flexors of the legs. There was loss of the middle and lower abdominal, and also the cremasteric reflexes. The tendon reflexes in the lower extremities were normal and there was no Babinski reflex or clonus. There was very slight impairment of touch, pain and temperature senses up to the level of the umbilicus. Vibratory sense

was diminished over bony and soft parts below the level of the umbilicus. Joint sense in the toes was not impaired. (Fig. 15.)

The *spinal fluid* was clear and xanthochromic. The jugular compression test showed a complete spinal block. The fluid contained 5 cells per cu. mm. and an increased globulin content. Other examinations gave normal findings.

DIAGNOSIS. Spinal cord neoplasm at 9th dorsal segment.

OPERATION. Laminectomy revealed an intradural neoplasm arising from the 9th dorsal root on the right side (Fig. 16). The tumor measured 1 cm. by 3 cm. The tumor and the attached nerve root were removed.

HISTOLOGICAL EXAMINATION (Dr. E. L. Bishop). Microscopic study showed an edematous structure composed of fibrous strands with a tendency to form whorls. There was marked vascularity; a few widely scattered spindle cells were found. The diagnosis was neurofibroma (Fig. 17).

COURSE. The patient has already made remarkable progress toward recovery. There is now no objective finding except a small band of anesthesia in the distribution of the 9th posterior nerve root on the right. He is free of symptoms.

COMMENT. This is a typical case of a spinal neurofibroma, an intradural extramedullary tumor arising from a nerve root. The first symptom was pain along the distribution of the posterior 9th thoracic nerve root and this was the sole symptom for two and one-half years. Such pain should always suggest the possibility of spinal cord tumor, even before other symptoms appear. As in Case 1 this patient had had an unnecessary abdominal operation.

CASE VI. W. L. C., a male, aged forty-seven years, was first seen on November 8, 1927.

HISTORY. *Pains* had been present in the feet for six years, sharp and shooting in character, "as if a nail were being driven into the feet." *Paresthesias* had been present for six years, consisting of a tingling and cold sensation in the feet. Numbness of the abdomen had been present for several weeks three years before examination. For six months he had complained chiefly of a sensation as if his "stomach were blown up and would burst." There had also been a sensation of numbness in the ulnar

aspect of the right hand for six months. Numbness in the legs had been noticed for six months. *Weakness in the legs* had been present for six
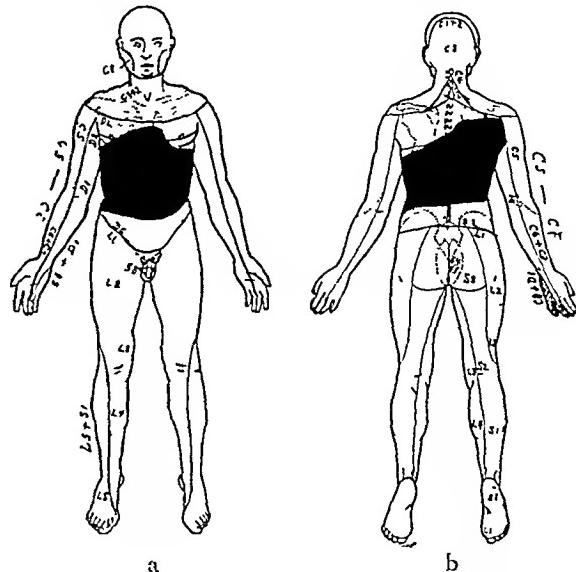
FIG. 18. Case VI. Charts showing sensory disturbances.

months, with slight unsteadiness in gait. *Slight difficulty in urination* had been present for six months. *Sexual impotence* had been present for one year. He had had a spinal fluid examination which showed a 2+ Wassermann reaction. He had been treated on the basis of this for syphilis for six years. The history was otherwise unimportant.

EXAMINATION. The *neurological examination* showed slight weakness in the legs, a positive Romberg and a slightly ataxic gait. The tendon reflexes in the lower extremities were exaggerated and there was a bilateral Babinski and a Chaddock reflex. There were positive Oppenheim and Schaeffer reflexes on the right side. The abdominal and cremasteric reflexes were not obtained. There was anesthesia to touch, pain and temperature sense over the trunk, from the 3rd to the 11th dorsal segments (Fig. 18). Vibratory sense was diminished up to the 2nd rib. Joint sense was lost in the toes. There was hyperalgesia in the ulnar side of the right hand.

The *spinal fluid* was clear and colorless, under 90 mm. water pressure. Jugular compression test showed a complete spinal block. The fluid contained 3 cells per cu. mm. and a marked increase in globulin. The Wassermann and colloidal gold tests gave normal reactions.

DIAGNOSIS. Spinal cord neoplasm in the lower cervical region.

OPERATION. A laminectomy in the lower cervical region showed that the spinal canal was enlarged in this region and filled by an

FIG. 19. Case VI. Diagram showing position of the cyst and the tumor.

enlarged spinal cord. The cord was cystic, and on incision a large cyst was opened, which extended upward to the medulla. This cyst did not appear neoplastic. It contained clear, slightly yellowish fluid. The cyst was widely opened. Following operation the patient suffered from severe pains in the hands, and a repeated Queckenstedt test showed the persistence of a spinal block. Re-operation revealed an intramedullary tumor at the level of the 3rd dorsal segment, below and unrelated to the cyst. The tumor was easily shelled out (Fig. 19).

HISTOLOGICAL EXAMINATION (Dr. E. L. Bishop). The specimen was unencapsulated, friable and very vascular. The cells were closley compacted, of varying size and surrounding small and poorly formed vessels filled with blood; they also encircled blood spaces, where they were in direct contact with blood. No degenerative changes were present, and no neurogenic elements could be found. The diagnosis was a neoplasm arising from the blood vessel wall, as sarcoma (endothelioma?) (Fig. 20).

COURSE. The patient has made a remarkable recovery. He complains only of paresthesias about the trunk. The area of anesthesia

has decreased in size to a small area in the right side anteriorly, between the 4th and 6th dorsal segments. The reflexes in the lower extremities

FIG. 20. Case VI. Microphotograph of tumor (sarcoma?).

are normal; there is no Babinski reflex. Joint sense in the toes is now normal. Urinary symptoms have disappeared and sexual potency has been recovered. There is only slight unsteadiness in gait. The abdominal and cremasteric reflexes are not obtained. All other findings are normal.

COMMENT. This example of an intramedullary tumor was of such interest that it has been reported elsewhere. The associated cyst within the cord is very rare. The recovery shown by the patient is greater than was expected.

We have presented 6 cases of compression myelitis caused by neoplasms of different types and locations. We have attempted to emphasize the symptoms which shoud lead one to suspect a compression of the spinal cord, and have discussed the methods employed in arriving at a correct diagnosis. The cases illustrate the very favorable results obtainable when the tumor is correctly diagnosed and removal is possible.

AN ANALYSIS OF
VERTEBRAL ANOMALIES*

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SEVERAL years ago the writer discussed vertebral variations, basing his conclusions on a study of some seven hundred skeletons in the museum of Western Reserve University's medical school. The present intention is a review of the earlier papers in the light of increased material. Repeated consideration of the different anomalies has led us to classify them from an etiological viewpoint into three groups, the effects of three distinct factors, phylogenetic, developmental and acquired.

PHYLOGENETIC VARIATIONS

The writers quoted in the former papers were interested particularly in theories of numerical variation of vertebrae. Paterson's[9] theory of inherent variability, Rosenberg's[11] retrogressive and progressive encroachment of the cervical and lumbar areas upon the thoracic, and Baur's[1] intercalation and excalation of segments in the body of the vertebral column were discussed in our former writings as unsatisfactory explanations of the process of numerical variation. The conclusion was drawn that such variation is part of a phylogenetic process, and is accomplished by progression of the pelvis upward along the vertebral column. As the last lumbar segment becomes fused in the sacrum and articulates with the ilia the next higher performs the function of the last lumbar and acquires its special morphology. Dwight[2] has discussed this phase of the problem.

Observations made in our anatomical laboratory show that there has been in primates a progressive shortening of the vertebral column parallel to specialization in other respects (see G. Elliot Smith[12])

and that while the human column is not constant in number of segments it is more stable than those of the anthropoids. Such shortening is confirmed by Keith[3] who states: "In the lower primates the 27th vertebra forms the first sacral, with the evolution of man the 26th, then the 25th underwent sacral modifications, the trunk being correspondingly shortened."

More recent discussions of vertebral variations are clinical in nature and based mostly upon roentgenograms of the lower back. Thus interpretation of the anomalies has been overlooked and the clinical importance of some of them exaggerated.

In the skeletons examined the number of cervical vertebrae was found to be constantly 7. The thoracic segments, being determined by rib attachments, varied from 11 to 13, the lumbar from 4 to 6. Since there were instances in which 11 thoracic were found with 6 lumbar, and 13 thoracic with 4 lumbar, the total number of vertebrae being unchanged, we have grouped for discussion the cervical, thoracic and lumbar segments as presacrals, ignoring the subdivisions. The number of vestigeal coccygeals and the sacral segments distal to the first are of no importance in this study. The thoracicolumbar compensatory variations noted above illustrate the fallacy of basing discussions of vertebral variation upon roentgenograms of the lower back only as the last ribs which serve as the determining point may be on the 11th, 12th or 13th thoracic vertebra. According to Keith[4] "about 2 per cent of bodies show the 19th (12th thoracic) segment without ribs, and in 6 per cent to 8 per cent the 20th (1st lumbar) carry ribs." There is therefore an inherent error of 8 per cent

to 10 per cent in estimating numerical variability of vertebrae from such x-ray data.

In the present study 1471 skeletons are included. Of these 1.5 per cent have but 23 presacrals and 4.1 per cent have 25, leaving 94.4 per cent with the modal number of 24 presacral vertebrae. Comparing these percentages with Todd's[13] figures for the primates we find that the human column is by far the most stable. His figures are based upon considerably less material but the difference in result is too great to be a matter of chance. In Todd's chart it is noted that the anthropoid apes have gone a step beyond man in shortening of the column, the orangs have acquired a modal number of 23 presacrals, but with marked variation from 22 to 24. The gorillas have not progressed so far but both they and the chimpanzees show distinct indication, compared with man, toward shortening. On the basis of specialization of the vertebral column Todd places man between the gibbon and the chimpanzee.

In dividing the material according to color and sex no great difference in variability is noted. The small number of female specimens and the preponderance of white stock over negro make comparison inexact, but there is apparently a slight excess in variability of the females over the males, and of the negro over the white. The variation in all, however, occurs about a common and well-impressed modal value of a human type of column, clearly defined from those of the other primates.

Bearing in mind the progressive shortening of the column by movement of the ilia upward on the lumbar segments the significance of partial sacralization of the last lumbar, and of partial freeing of the first sacral segment, is readily perceived. Enlarged transverse processes of the last lumbar, and variation of the planes of the articular processes from medial to transverse position also acquire a definite meaning as intermediate stages in the absorption of the last lumbar by

the sacrum in the shortening process. Such anomalies are frequently seen in roentgenograms of the lower back and have been ascribed considerable importance in the production of backache. At most they represent points of lessened resistance to mechanical strain.

Of the columns examined 4.7 per cent showed partial sacralization of the 24th segment and 1.2 per cent showed partial asacralization of the 25th. Adding the former to the 1.5 per cent showing complete sacralization of the 24th segment, and the latter to the 4.1 per cent with complete freeing of the 25th we find approximately an equal number of columns to either side of the modal column of 24 presacral segments; but since shortening is expressed by 1.5 per cent complete loss of a segment and 4.7 per cent partial, while lengthening is expressed by 4.1 per cent complete gain and 1.2 per cent partial, the latter is the more strongly marked tendency.

Simple enlargement or decrease in size of the transverse processes of the last lumbar vertebra without impingement or articulation with the sacrum or ilium is a less marked indication of numerical variation, but until a modal type of last-lumbar transverse processes has been determined such evidence cannot be evaluated. Impingement of a last lumbar transverse process on the ilium without contact with the sacrum is rare, as sacralization takes place first. This is of interest in connection with our observation that in columns of fewer presacrals the superior surface of the sacrum is higher in relation to the iliac crests than in columns of more presacrals. Depression or elevation of the sacrum between the ilia is a part of the process of numerical variation. Definite evidence of lumbo-iliac impingement without sacralization was found in only 0.54 per cent of the columns examined. Our earlier paper was misquoted in this respect by Sherwood Moore[7] who stated that we found contact between the lumbar process and the sacrum in only 5 of the 748 skeletons reported

at that time. He substituted the word sacrum for ilium, which according to the paper quoted made the difference between 5 and 50, the latter number having shown contact with the sacrum.

These then are the anomalies which we term phylogenetic because they represent stages in evolutionary shortening of the spinal column: partial and complete sacralization of the 24th vertebral segment, partial and complete asacralization of the 25th, enlarged transverse processes of the last lumbar, impinging or articulating with the sacrum or ilium, and variation of the planes of the articular processes between the last lumbar and first sacral segments toward the medial lumbar or the transverse sacral modes.

DEVELOPMENTAL ANOMALIES

The posterior arch of a vertebra is formed ultimately from a folding over and midline fusion of ectoderm. At birth each lateral half of a neural arch consists of a flat bony plate united in cartilage by an inverted L-head with the body of the vertebra. The articular processes are not yet distinct, the plates simply overlapping slightly those of the adjacent segments. As the plates develop their inferior medial angles unite and from the site of union there grows the spinous process. From the superior and inferior lateral angles there develop the respective articular processes. Interruption of the above plan of ossification results in anomalies which may be termed developmental. Such anomalies involve particularly the spinous and articular processes and the laminae. The most commonly recognized of the type is the bifid neural arch. This is the usual condition in the 4th and 5th sacral segments and is frequent in the 1st sacral. In 1.2 per cent of our series it was found in the last lumbar. In some of these the spinous process was completely formed from one lamina only. In others there was complete lack of the spinous process with a central defect in the bony arch.

Considerable clinical importance has been ascribed to variations in the articular processes, particularly of the lumbosacral articulation. I have not been able to find that a modal type for such processes has been determined. They vary greatly in size, shape and angle of projection. Poorly developed and asymmetrically formed articular processes strongly suggest mechanical instability and susceptibility to ligamentous injury, but so long as a modal type has not been determined the frequency of anomalies cannot be discussed. Our observations convince us that they are of frequent occurrence and of clinical importance.

The condition described in our earlier papers as separate neural arch has long been recognized but its frequency of occurrence has not been appreciated. Poirier[10] referred to it, and it has been mentioned in anatomical discussions as a rare variation. Le Double[6] in 1912 recorded 22 instances in literature and added 11 of his own. In 1923[15] the writer reported 31 specimens found among 748 skeletons (4.28 per cent), and in 1924 Turner[14] described the condition, reporting several cases.

Neugebauer[8] ascribed the condition to lack of fusion between two centers of ossification existing in each lateral half of the neural arch. This explanation has apparently been followed except by Lane[5] who attributed the separation in his case to excavation of the bone by rotation of the last lumbar on the sacrum. Neugebauer's theory would be sufficient if his postulated double centers of ossification were actually found. I have not yet discovered embryological confirmation thereof in study of specimens or in literature.

The separation of the neural arch occurs in the lamina between the superior and inferior articular processes, so that the body of the affected vertebra with its superincumbent weight loses bone connection with the spinous and inferior articular processes that anchor the trunk to the pelvis. This is a most important

factor in spondylolisthesis and should be more generally recognized. The defect may be unilateral as in 15 of our 57 specimens, 13 on the right and 2 on the left, or bilateral, as in 42. It was found in female skeletons 3 times and in males 54. Once the 1st lumbar was affected, once the 3rd, five times the 4th, 45 times the 5th lumbar, and five times the 6th.

It has been suggested that the separate neural arch is really a fracture. If so the last lumbar vertebra is the most frequently fractured of all bones, as 3.8 per cent of the skeletons examined showed such separation. Consideration of the individual specimens shows no callus formation or rounding off of the fragments suggesting fracture without union. In bilateral defects of the arch separation of the fragments might account for lack of attempted union, but in the unilateral defect immobilization of the parts by the intact lamina is perfect, and these also show no callus or attempt at union. In the writer's opinion actual disunion, when it occurs, is the result of trauma, but there is a pre-existing defect in the neural arch so that fibrous or cartilaginous tissue is ruptured, rather than bone, and this shows no bone-callus forming function. Such tissue separates more readily than bone and stretches under strain so that displacement of the fragments becomes more and more marked, anchorage of the spinal column to the sacrum depending entirely upon the stretching fibrous structure. Some of the specimens examined showed beveling of the lumbosacral surfaces suggesting frequent sliding of the one on the other.

Separation of the neural arch was found associated with bifid arch in several columns. In this condition one or both of the posterior quadrants of the arch with their inferior articular processes were free from the bony ring, resulting in particularly unstable lumbosacral mechanisms.

ACQUIRED DEFECTS

Defects of the third group include those due to injury and disease. It was found impossible at times to determine in a given case which of these factors were concerned, or to differentiate either factor from a possible developmental defect of an articular process, but in most instances the etiology was clear.

The last lumbar vertebra, situated at the greatest convexity of the lumbar curve, is not so subject to compression fractures of its body as are the higher segments. For the same reason it is more subject to fracture or separation of its articular processes, and evidence of such injury was found in several instances. Fracture of transverse processes also occurred in the mid and upper lumbar segments which are less protected than the lowest. Some of these had united with considerable deformity.

Most frequently found evidence of disease was of hypertrophic arthritis affecting the lower lumbar segments and the sacroiliacs. A number of the latter were completely fused, even in skeletons showing very little lipping elsewhere, leading the writer to the opinion that sacroiliac arthritis is a very common ailment. A detailed study of hypertrophic changes was made of the first 625 columns examined, and conclusions drawn that such changes occur first and to greatest extent where mechanical strain is greatest, and that though the type of individual with broad heavy bones described by the Boston writers is more subject to hypertrophic changes, the light slender type is not immune. Hypertrophic changes begin in the lower spine at about the thirty-fifth or fortieth year and progress with age so definitely that they are of importance as a criterion of age. Local irritation of any kind exaggerates such changes.

Tuberculous lesions were present in a number of the spinal columns, usually involving the upper lumbar and lower thoracic vertebrae. After consideration of these the following facts were thought worthy of emphasis: Multiple separate tuberculous lesions occur in certain spinal columns, indicating the necessity of careful

study of the entire column in every case of Pott's disease, particularly before ankylosing operations are advised. Productive bone changes occur in tuberculosis notwithstanding the prevalent opinion that hypertrophic changes refute diagnosis of this disease. Articular and muscular processes of the vertebrae are frequently involved in the lesions as well as the centra. There may be extensive lesions without deformity, the bone involvement being superficial but affecting several segments, and complete bridging of the intervertebral spaces taking place. Abscess formation is the rule. Lipping was most marked when the articular processes were included in the diseased area.

CLINICAL SIGNIFICANCE OF ANOMALIES

In the writer's opinion *complete* sacralization or asacralization of a segment can have no other effect than shortening or lengthening of the spinal coeumn. A short column is probably better fitted for heavy work than is one longer and more mobile, but of course the condition is congenital and the actual strength of an individual back is a matter of muscle development and functional education. To attribute backache to the presence or absence of an abmodal segment is questionable.

Unilateral sacralization, articulation or impingement of transverse processes results in asymmetrical mobility and strength of the parts, and predisposes to musculo-ligamentous injuries. But again we must remember that these anomalies are congenital, and nerves, bursae and muscles are adjusted to them, so that some factor is required for the production of symptoms other than the presence of such an anomaly.

Considerable clinical importance has been attributed to enlarged transverse processes. They have been removed by some operators to relieve tension on the lower lumbar nerves, by others to relieve pressure on lumbo-iliac bursae. Surgeons who have excised such processes to relieve nerve tension have apparently not compared the symptoms they purpose to relieve with those present in a known case of nerve tension such as cervical rib syndrome. I have yet to observe a patient showing actual neuritis of the lower extremities due to lumbar tension, and I have observed patients who have been advised to have their transverse processes removed, and others who have later had it done. In none have I seen the sensory disturbances, trophic changes, neuralgias characterized by intense local sensation of burning and formication, and the sympathetic derangements of the cervical rib syndrome. Rather have such patients complained of the ordinary symptoms of arthritis and musculo-ligamentous injury, such as limited motion, muscle spasm, local tenderness and pain referred along the distribution of nerves which supply the affected joint. If in rare instances symptoms of actual neuritis do occur, it is to be remembered that in cervical rib symptoms appear only after excitation by postural fault or other cause, and are usually relieved by correction of such fault.

Bursal sacs have been described existing between enlarged last lumbar transverse processes and the ilium or sacrum. If there is articulation or fusion between these bones there is of course no bursa. Nature seems to have no difficulty in providing bursal sacs wherever they are needed to prevent friction. No doubt such a sac might be formed in the above-mentioned position and respond to irritation with symptoms similar to bursitis elsewhere. Such a condition in such a position would be very difficult to diagnose. It would probably respond to conservative treatment as well as does subdeltoid bursitis.

The spinous processes and laminae furnish anchorage to powerful ligaments and muscles. Lack of such processes necessarily means diminished strength of the part. Defective articular processes threaten bony stability of the spinal column, predisposing to ligamentous injury or sprain with resulting local tenderness, muscle spasm, pain on certain motions

only, and a history suggesting such injury. Neglected sprains readily become chronic.

Acquired defects of the vertebrae are too numerous for discussion here. The one fact most strongly impressed upon the writer's mind by the study of these 1400 spinal columns was the unsuspected frequency of sacroiliac arthritis severe enough to cause actual fusion of the joint.

SUMMARY

Study of a series of some fourteen hundred skeletons has led the writer to the opinion that anomalies of the spine are confined particularly to the lumbosacral area of the column and occur as the result of evolutionary, developmental or environmental influences. In the first group are complete and partial sacralization of the last lumbar vertebra, complete and partial asacralization of the first sacral segment, enlarged transverse processes of the last lumbar impinging or articulating with the sacrum or ilium, and variations in the angles of the articular processes. All these represent stages in the phylogenetic shortening of the spinal column. They are of clinical importance as they affect the stability and mobility of the back.

Developmental anomalies result, from defective ossification of the posterior parts of a vertebra. They are expressed as defective or absent spinous processes and inefficient articular processes as well as by separate neural arches. Their presence in a back predisposes to strains and sprains or even spondylolisthesis.

The third type of defect is the result of injury or disease, the most frequent lesions being fractures and arthritis.

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DIAGNOSIS AND TREATMENT OF
ACUTE ABDOMINAL PATHOLOGY*

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THE formidable death rate in emergency surgery of the peritoneal cavity is one of the reproaches of modern medicine. The mortality in acute appendicitis, for instance, varies from 4 to 12 per cent. The mortality in intestinal obstruction, which is generally believed to be between 30 and 40 per cent, actually is between 50 and 60 per cent. Such figures could be multiplied. It is clear that something is radically wrong with the modern surgical treatment of intra-abdominal pathology, and that in this one regard, if in no other, we must needs clean our medical house.

In reviewing large series of cases one cannot fail to be impressed by the fact that the time element is the primary factor in the death rate, that delay explains most of the fatalities, not only delay in diagnosing the condition present but also delay in instituting treatment when once the diagnosis has been made. The character of the pathology cannot always be gauged by the time which has elapsed since the onset of the symptoms, but the prognosis is invariably dependent upon it. Such a report as Bower's, from the Samaritan Hospital in Philadelphia, in which more than 1000 abdominal emergencies are analyzed, is worthy of careful scrutiny. In 65 cases of ectopic pregnancy there were no deaths in those in which operation was done within twenty-four hours, but there was a 4.1 per cent mortality in those in which operation was done later. In 13 cases of acute pancreatitis the mortality was nil for the early operation, but 66⅔ per cent for the delayed operation. In 52 cases of ruptured duodenal ulcer the mortality ranged from 4.35 per cent for the early operation to 60 per cent for the

delayed operation. In 129 cases of intestinal obstruction it ranged from 13 per cent for the early operation to 63 per cent for the delayed operation. In 751 cases of acute appendicitis it ranged from 4 per cent for the early operation to 15.7 per cent for the late operation. Statistics such as these, and they could be duplicated, I am sure, in any clinic, prove most conclusively that the principal thing which can diminish the mortality in emergency surgery of the abdomen is the lessening of the time between the onset of symptoms and the recognition of the condition with the subsequent resort to operation.

It is not my intention to mitigate in any way the responsibility of the surgeon when I point out the part which the medical man must play in the attainment of this ideal. Surgeons make woefully many mistakes, they temporize and delay when action is imperative, they are radical when they should be conservative and conservative when they should be radical, but it cannot be denied that only rarely is the management of the case theirs from the onset. More times than I care to remember I have been called to see a patient in consultation, only to find him in extremis after days of expectant medical treatment; and I have operated, not because I had any real hope of saving his life, but because I realized that what chance he did have in a game where all the cards were stacked against him lay solely in my belated endeavor to do what should have been done hours and days before. In such instances, of course, the original pathology is usually lost sight of in the overwhelming sequels of peritonitis and toxemia.

The medical man is not called upon to do the work of his surgical confrère, but it

is not too much to ask that he cultivate a sound surgical judgment. He must comprehend that certain cases are in their very essence surgical and not medical, and that in them surgery should be a first aid and not a last resort. His chief function is to diagnose the condition, not to treat the disease, or rather, not to treat it until its non-surgical aspect has been definitely proved.

On the other hand, the surgeon is equally responsible for the diagnosis. By no means should he merely operate on the indications set forth by the internist. That, as J. W. Williams has said in another connection, is purely a carpenter's job, and there is no particular credit attached to being a good carpenter. Operative skill is more easily acquired than surgical judgment and diagnostic acumen, and the man who possesses dexterity alone is among the number of "brilliant operators," from whom, with Moynihan, we would do well to pray to be delivered when our hour has come.

In acute conditions within the abdomen there is no time for leisurely tests, no room for temporizing measures, no excuse for uncertainties and hesitations. These patients are all of them gravely ill and action of some sort seems imperative. Yet the wisest and kindest course is, at least momentarily, to withhold our hand. Many of the disasters in abdominal surgery come to pass because pain, the universal symptom, which is always nature's protective response to injury, is treated as an entity rather than as a symptom, as a pathology in itself rather than as a sign of pathology within the peritoneal cavity. It should be axiomatic with both internists and surgeons, and both groups need the admonition equally, never to give morphia, never to give any anodyne whatsoever for the relief of any intra-abdominal condition until it is clearly established what that condition is. I make this plea with special feeling, for I can recall not one but a dozen such cases in which I have been required to make a diagnosis, a diagnosis on which

literally a life hung, when every physical sign had been masked by a smoke-screen of morphia.

Likewise it should be axiomatic to refrain from purgation under these circumstances. Never should a purgative be given until the surgical aspect of the case has been disproved beyond a shadow of doubt, for it may be the one thing needful to convert a localized lesion into a generalized one. Moynihan, speaking of appendicitis, does not hesitate to say that over many years he cannot recall a single case in which perforation and gangrene had not been preceded by purgation, or, as he puts it, in which purgation was not only an impressive antecedent but also a definite cause. If we cannot do the patient good, at least let us stay our hand, let us refrain from doing him harm.

Speed in diagnosis and speed in treatment are essential in the management of intra-abdominal emergencies, but it is an excellent plan to make haste slowly. Nothing is gained by saving minutes, for a wisely considered diagnosis saves hours in the end. As Da Costa has well put it: "An intuitive diagnosis is a rapid method of reaching a wrong conclusion," and even in the most gravely ill patient there is always time to arrive at a correct conclusion, so that treatment can be instituted in the light of knowledge rather than in the shadow of ignorance. At least, if full light cannot be obtained, treatment should not be instituted until there has been due consideration of the symptoms of a given condition, of the physical signs, of the history, and of certain laboratory tests.

Pain is the constant and outstanding feature in all intra-abdominal pathology. It is usually of sudden onset and intense character, and most often, no matter where it eventually localizes or where the true pathology is situated, it originates about the umbilicus. It may reach its acme gradually or it may appear with sudden and agonizing intensity, but whatever its type and course it is an inevitable

concomitant of intra-abdominal pathology. It must be remembered, however, that pain is very largely a reflex matter, that the abdominal viscera themselves are insensitive, even when they have become pathological, and that a proper comprehension of the mechanism by which pain is produced in visceral disease, a subject far too complex to be entered upon here, is a prerequisite to a correct diagnosis.

Vomiting is a second fairly constant symptom, though the single act at the onset of the disease means little, and the repeated act may signify anything from a mere reflex of the sympathetic nervous system to complete intestinal obstruction. In the latter condition and in late peritonitis it is not accompanied by nausea and is little more than a mechanical regurgitation of the jejunal contents. Fecal vomiting is always an evidence of terminal pathology and should be regarded as a sign of impending death rather than as a symptom of disease.

Shock is a late symptom of such pathology as acute pancreatitis, ruptured gastric or duodenal ulcer, or the torsion of an organ, but unless hemorrhage is present, as in ruptured tubal pregnancy, it is never an initial symptom. It is always, however, to be regarded as evidence of an abdominal disaster, and when it appears in acute infectious processes it is usually the sign of an overwhelming toxemia.

It may be categorically stated that where there is fever there is infection, and a temperature elevation in diseases which are not primarily inflammatory, such as torsion of an organ or rupture of a hollow viscus, is an indication that the process has reached the infectious stage. As a rule, temperature elevations are not marked in the early stages of any intra-abdominal pathology, and I have seen even complete gangrene of the appendix with no fever at all. A distinctly subnormal temperature is a frequent accompaniment of marked shock.

The pulse rate, at least in the early stages, is likewise of little assistance.

Moynihan was the first to point out that in the rupture of a viscus it may remain approximately normal for a considerable period of time and in ruptured tubal pregnancy, while it is alarmingly weak and rapid almost from the onset, this is due to hemorrhage rather than to disease. A consistently augmented pulse rate is always a sign of progressing pathology and is of grave import.

The localization of rigidity is fairly conclusive proof of the involvement of the underlying viscus, though absence of localized rigidity is not necessarily a synonym of absence of local pathology. For one thing, the organ involved may be displaced, as when the appendix lies in contact with the non-demonstrative area of the parietes or a ptotic gall-bladder occupies the normal position of the appendix. Cope has pointed out, too, that fatigue of the reflex is a physiologic phenomenon which inevitably occurs when a state of contraction has lasted beyond a certain length of time. The investigation of this sign should always be supplemented by the endeavor to locate what Moynihan calls "the area of supreme resistance," the maximum point of tenderness within the unyielding protective wall. Pain may vary in location but soreness is always referred to the region of the offending organ.

Distention is a late sign and usually means that peritonitis is present, with involvement of the intestinal tract. Palpable masses carry their own interpretation, though it is well to emphasize again that only a constantly present mass permits the diagnosis of a definite neoplasm. Tumors which vary in size and consistency and which tend to disappear and reappear are practically always of intestinal origin, with their existence dependent upon intestinal peristalsis.

For my own part, I agree with Mackenzie that a carefully elicited and carefully interpreted history is even more important than a study of the physical signs. Moynihan has wisely pointed out that the catastrophes which occur within

the abdomen are never in the strictest sense acute but on the contrary are usually the result of an abrupt transition from a quiescent to an acute phase in a disorder of long standing, and Deaver echoes him when he says that few abdominal emergencies are the result of "virgin" pathology. Practically every abdominal catastrophe of which it is possible to conceive has its premonitory symptoms for those who run to read. Equally important is the history of the present attack. It is not enough to know what symptoms are present; a knowledge of their relation to each other is necessary to complete the picture. In this connection, let me warn you to permit the patient to tell his own story. Question him, if you will, upon specific points, but in the main let him give you his own reaction to his own symptoms. It is not only in a law court that the witness, if properly led, will answer whatever he thinks the judge would wish to hear.

"Symptoms," says Mackenzie, "in respect of concepts are like the materials used in the construction of an edifice. We may know that detached they can be used to build a house, but their relative values and uses are realized only as we find we can work them into an edifice. It is when the symptoms are logically included in a hypothesis that we clearly ascertain their origin and relative values." In making a diagnosis, therefore, it is always well to remind oneself of the various conditions which may occur within the abdomen, all of which may be foreshadowed by one or more of the symptoms and signs which have been elicited, and it is likewise well to remind oneself of the various extra-abdominal diseases which may give rise to intra-abdominal symptoms, particularly diaphragmatic pleurisy, pneumonia, and the gastric crisis of tabes dorsalis. That mistakes can occur is evidenced by such a report as that from the Cook County Hospital, which shows that in 1000 cases of tabes, 97 patients were operated upon during the gastric crisis for some supposed acute abdominal pathology. A definite mental rehearsal of all possible conditions is a mechanical procedure, I grant you, but I have seen it clear up obscure diagnoses when more scientific reasoning had failed to bring light. Naturally, the chances are that the pathology is of the more ordinary variety, but it must never be forgotten that rare conditions must be recollected and eliminated, on the premise that any pack may hold a joker.

A consideration of the sex incidence and the age incidence can do no harm, though naturally this is not a reliable diagnostic method. Obviously one would not seek for diseases of the female pelvis except in the female, but it is not always realized that such conditions as acute pancreatitis, ruptured duodenal ulcer and renal colic are more common in men, while ruptured gastric ulcer, biliary colic, torsion of the spleen and displacement of the kidney are more common in women. Appendicitis may occur at any age from infancy to senescence, but it is most usual during adolescence. Malignancy is the commonest cause of obstruction in adults past middle age. Intussusception is most usual in very young children. Acute pancreatitis and acute biliary conditions are rare in youth. Ectopic pregnancy is limited to women during their functional life. All these are, mechanical considerations, but not on that account to be entirely ignored.

It is in a survey of the patient himself that modern medicine exhibits its gravest lack. We are prone to lean so heavily upon the laboratory that we forget to be good clinicians. The very decubitus of the patient, his restlessness or immobility, the manner in which he obeys a request to move, the condition of the skin, the facies, all have their own story if we but stop to read what is written. Nor should the respiration ever be ignored. Frequently the rate is increased in abdominal conditions as a sort of compensation for the rigidity of the abdominal wall, but the increase is never so marked as it is in respiratory conditions. Cope has pointed out that the

normal ratio of pulse to respiration is 4 to 1, that this ratio will be materially affected if respiratory disease is present, and that a ratio of 2 to 1 is definite evidence of pneumonia, which condition, by the way, may frequently exhibit its first physical sign in a characteristic movement of the alae nasae.

It is never well to confine one's examination merely to the suspect area. I think it is fairly generally conceded that no emergency abdominal operation should ever be performed on a woman until a vaginal examination has been made also, but it is often forgotten that a rectal examination may likewise be helpful, especially in children; many times by this means I have been able to identify a pelvic appendix, an intussusception or other low obstruction, and of course tubal and ovarian pathology. As to the abdominal examination, the chief essentials are a trained touch and unvarying gentleness; a patient who is hurt by rough manipulations will instinctively protect himself by an added rigidity of the abdominal wall and much of value will thereby be hidden. Percussion and auscultation are sometimes helpful in spite of the rather general tendency to ignore them.

The clinical aspect of every case is, as I have pointed out, the essential aspect. Never in intra-abdominal pathology are fine-spun diagnoses based on laboratory data warranted. Blood chemistry, the CO_2 combining power of the blood, examinations of the spinal fluid except on specific indications, these and similar tests are excellent in their place but their place is not here. Certain examinations, however, should not be omitted. Urinalysis should be routine, to eliminate certain types of renal disease which may give rise to intra-abdominal symptoms, and also to establish the fact that organic disease which would contraindicate certain methods of anesthesia does not exist. Likewise a complete blood count should be routine, though the findings should not be slavishly depended on. A roentgen-ray examination of the chest is valuable in any case in which an early pneumonia may exist but in which the signs are not yet evident on percussion. I cannot, however, inveigh too strongly against the giving of a barium meal in any acute intra-abdominal pathology.

It would not be possible, in a paper of this general character, to discuss the differential diagnosis of these diverse abdominal conditions which we have been considering, but I would remind you that practically every such disease offers at least one salient feature upon which to base a diagnosis. Thus appendicitis should never be diagnosed as such unless it has been ushered in with pain. A ruptured gastric or duodenal ulcer causes a board-like rigidity of the abdominal wall which is seen in no other condition. The characteristic pelvic findings, supplementing the equally characteristic history of supposed pregnancy, sudden abdominal pain and collapse, warrant the diagnosis of ruptured tubal pregnancy even without the aid of the fluctuating leucocytosis to which Farrar has called attention. Pain in the right hypochondrium, with referred pain under the right shoulder-blade, supplementing a history of digestive disturbances in an obese, middle-aged individual, carries its own diagnosis of cholecystitis. And some similar characteristic feature could be pointed out for every type of intra-abdominal pathology.

With possibly two exceptions, upon which I shall comment later, it may be stated categorically that any abdominal pain which lasts for more than six hours in a previously well person, if accompanied by vomiting, an increasing pulse rate, or some one of the other signs and symptoms we have mentioned, demands surgical intervention, though only very rarely is one justified in opening the abdomen for pain alone. Whipple's rule, to eliminate non-surgical conditions and then to operate at once, if strictly adhered to, may save many lives, for faith in medical treatment for strictly surgical conditions is a depraved and baseless faith which can terminate only in disaster.

Unless there is absolutely no doubt as to the exact pathology present the incision should be centrally placed, and in any case it should be sufficiently long to permit a full inspection of the abdominal contents. Once the lesion is located, the procedure should be swift and thorough, though it is never well to be overzealous. The experienced surgeon is content merely to save the patient's life, even though he must return later to finish the work. It is the tyro who must complete the operation even though he loses the patient. It is wise to take such steps beforehand as may be necessary to forestall shock, to be ready for hypodermoclysis, for infusion or for transfusion before the urgent need for them arises. As for anesthesia, my own preference is for a general one unless there is some definite contraindication to its use. I am willing to grant all the arguments which may be urged against it, but in my opinion the prolongation of the operation which is almost inevitable when spinal or local analgesia is employed, as well as the equally inevitable trauma to the tissues, entails more of a risk for the patient than the same procedure swiftly and gently done under nitrous oxide or ethylene anesthesia, or even, if the others be impracticable, under ether.

Certain conditions which are eventually surgical are definitely not surgical in their acute stage, the chief of these being cholecystitis and salpingitis. Neither of them is a true surgical emergency. Infections of the gall bladder tend to localize rather than to generalize; operation in the acute stage, when the physiologic balance is disturbed, is often a hazardous procedure; and cholecystostomy, which must usually be done, is by no means as satisfactory an operation as cholecystectomy, which is practically always possible in the chronic conditions. As for acute salpingitis, I am inclined to share Chipman's view that to open the abdomen for that condition is a surgical calamity. Certainly if one has fallen into the error, the only conservative course is to retreat. The disease tends to localize; death during an acute attack is a very unlikely contingency; the death rate in the cooled cases is several times lower than in the uncooled if surgery must eventually be done; and finally, and most important, in a very fair percentage of cases the first attack is also the last and no surgery is ever necessary.

There will always be a certain small percentage of cases in which, after every diagnostic aid has been exhausted, the pathology is still obscure and the patient's condition is steadily growing worse. I hold no brief for promiscuous surgery, but I do believe that in that type of case an exploratory operation is a truly conservative procedure. If nothing is found, at least no great harm has been done and active medical treatment can safely be proceeded with. My own experience parallels that of C. H. Mayo; you will remember that he says he has never seen a patient die as the result of an exploratory incision, though he has many times seen patients die because it was not made. And the exploration should be done promptly and not when the patient is moribund. However, if the measures which we have outlined are uniformly employed, if there is a careful correlation of subjective symptoms and clinical findings, if rational laboratory aid is invoked, then the percentage of doubtful cases will be so small as to be minimal, and our present shocking mortality in acute surgery of the abdomen will show a prompt and healthy decrease.

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ACUTE HEMATOGENOUS INFECTION OF KIDNEY*

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THE medical literature of the last two decades abounds with articles on kidney infection. The articles have frequently been scholarly and instructive. Few have been original and brilliant. Still a large majority have failed in their object of elucidating the subject of kidney infections.

I do not intend to cloud the issue further or add to the confusion by attempting any criticism of the several classifications already existant, or discussing at length the theories regarding the roads pursued by the offending organism in reaching the kidney and causing the lesion under discussion. On this particular issue the reader is convinced that the disease is almost invariably carried to the cortex of the kidney by the blood stream. The morphology of the pathological organism at fault in acute unilateral hematogenous infection of the kidney, the pathologist has definitely settled. The staphylococcus is the most frequent offender; the streptococcus ranks second as causative factor.

In this country Dr. George E. Brewer of New York in 1908, emphatically called our attention to a severe form of acute kidney infection. The heading of his treatise reads "Acute Unilateral Hematogenous Infection of the Kidney." This title may sound long; it is proven however to be concise, accurately descriptive and confers at once the proper conception of the disease he describes. Clinically and experimentally he has unquestionably proved the existence of the malady. He has experimentally demonstrated that (exclusive of those occasional infections of the kidneys caused by the mechanical obstruction to the outflow or egress of urine as in stricture, tumor of the bladder, or violent vesicular tenesmus) kidney infections are invariably carried there by the blood stream.

When we speak of "acute unilateral hematogenous infection of the kidney" we imply that condition, or disease of the kidney that occurs as a result of the blocking of the minute blood vessels of the cortex of the kidney by microbic emboli. Ordinarily, we assume that one of the various functions of the glomerulus is to filter the bacteria of the blood stream and thus rid the individual of the bacteria in the blood. Owing to a lowered resistance of the kidney or some impediment to its function or some anatomical anomaly or increased functional demand as in pregnancy, the glomeruli fail to perform properly their duty, and these microbic emboli carried to the glomeruli for filtration are deposited within the cortex of the kidney.

The subsequent progress or retrogression of the disease will depend on the resistance of the individual and the virulence of the offending organism.

a. As a result of the combat we may have an immediate conquest of the infection with very little destruction of kidney substance and recovery after palliative conservative measures are instituted. Numerous cases of this class are never diagnosed and even when diagnosed cannot be confirmed. Some of these cases may, however, suffer a second attack because of their added lowered resistance, and may subsequently come to operation.

b. There are mild acute cases which come to the operating table very early and will present few or numerous small areas of chocolate colored mottling of the cortical surface. These discolored areas are slightly raised above the surface of the surrounding

apparently healthy tissue. The capsule is slightly adherent. This discoloration in spots is interpreted as areas of congestion where the inflammation has not yet reached the stage of abscess formation.

The writer wishes to emphasize the absolute importance of delivering and inspecting the cortex of the kidney thoroughly after stripping the capsule. Decapsulation does no harm to the kidney, and will at times uncover pathology that cannot otherwise be discovered. A kidney may not be enlarged, and the consistency may feel normal, still isolated areas of infection that cannot be palpated may present themselves to view. Only after thorough inspection may we aquit the organ.

c. The severe form of this ailment will present pathology that will impress even the most skeptical. Scattered throughout the cortex of the kidney (after stripping a rather intimately adherent capsule that tears during decapsulation) we observe numerous miliary abscesses. These pinhead areas of suppuration may be universally scattered over the anterior or posterior surface of the cortex, or limited to the cortex of the upper or lower pole, or be in evidence here and there, and few in number, just under the capsule. Coalesence of several of these miliary abscesses may give rise to a larger abscess. When a larger vessel has been blocked by bacterial emboli, we may find a triangular shaped septic infarct.

d. In the severest type of infection characterized by Albarran as the fulminating type, we find a kidney which feels to the examining hand like mush.

Unfortunately, these acute kidney infections are often not diagnosed until the disease has progressed and the suppuration has spread beyond its original limitations. One of the most frequent sequellae of acute unilateral hematogenous infection of the kidney is perinephritis, and the formation of a perinephritic abscess. Many of the so-called subphrenic abscesses are caused by protracted cases of this disease.

General sepsis with rapid exodus is not infrequent. Subsequent involvement of the second kidney is rare; yet in cases where the disease is neglected for a long time, involvement of the other kidney may occur. The writer is at present treating a case of bilateral perinephritic abscesses where the patient was poulticed for six weeks after diagnosis of acute hematogenous infection of right kidney had been made. I am quite certain that the left kidney had been infected by microbic emboli circulating in the blood obtained from the suppurating right kidney.

The disease is most prevalent in the third and fourth decades of life.

Invariably, if a careful history is obtained we will learn that some mild or severe infection, general or local, antedates the present trouble. Grippe; tonsillitis; pharyngitis; a furuncle; a boil; a carbuncle; a paranychia, may have been the causative factor.

The severity of the symptoms will depend on the virulence of the infection; the resistance of the individual affected, and the recentness of the onset. The symptoms of the general toxemia will often mask the local signs and symptoms and lead to erroneous diagnosis. The affliction may be ushered in with a severe chill, nausea and vomiting, fever ranging from 102°F. to 106°F., which persists in being high and often makes us include typhoid fever in our early attempts at diagnosis. Rapid pulse, severe prostration, pain and tenderness in the abdomen (most often the right half) and distention is not rare. Thus the picture presented to us is immediately suggestive of an acute surgical abdomen. The careful and experienced clinician will go further than the anterior surface of the body. Pressure at the costovertebral angle will elicit immediately most exquisite tenderness in all cases of acute hematogenous infection of the kidney when seen early. Permit me to emphasize this point in making routine abdominal examinations. In early cases the marked tenderness over the costa-

vertebral angle in the disease under discussion is pathognomonic. In the later stages of this disease, when the capsule has already perforated by extension of the suppuration, and the extreme tension is relieved, exquisite tenderness is no longer obtainable, just as tenderness over McBurney's point will be diminished, or disappear after the distended appendix has perforated, or after any boil is opened and tension is relieved. The lower pole of the kidney may be palpable and tender. Once the kidney is under suspicion the gamut of kidney investigation must be pursued. The routine urine examination, as a rule, will reveal nothing in the early stages. Ureteral catheterization is of importance. Diminished flow from the affected side may be noted; diminished functional activity may be discovered, and, most essential, is the finding of a few red blood cells, and a moderate number of pus cells. Although the cortex of the kidney is the seat of numerous miliary abscesses, the routine urine examination may reveal nothing abnormal. The reason is obvious. We may advance the theory that since the function of the affected kidney is considerably diminished, the functional activity of the other kidney is comparatively increased, and the dilution of the decreased amount of urine secreted by the affected kidney is so great that the ordinary tests fail to show the few pus cells or red blood cells that are found on cystoscopic examination. Another feasible cause is that since we know that only the cortex is affected, and since the secreting areas of the kidney are not affected, very little pathology will be discernible in the urine. The cystoscope may be of assistance.

It has already been intimated that acute hematogenous unilateral infection of the kidney is far from rare. Too frequently, the cases are undiagnosed. On the writer's service at the Jewish Hospital, there have been 52 diagnosed cases since November, 1913. Of these forty were confirmed at the operating table; 12 were discharged recovered after conservative palliative treatment and therefore subject to erroneous diagnosis. The signs, symptoms and course of the disease however were such as to convince those in charge of the service that these patients were suffering from acute unilateral hematogenous infection of the kidney, and had the severity of the symptoms increased they would have unhesitatingly proceeded to explore the kidney suspected. Two of these series of 12 conservatively treated cases returned with pronounced symptoms of re-infection which required operation; and the diagnosis was thus absolutely confirmed.

One might believe it strange that the acknowledged expert urologist does not see these early infected cases much more frequently. The reader might presume to offer an explanation that the general surgeon who sees a large number of cases of "acute abdomen" is wont to see acute unilateral hematogenous infection of the kidney much more frequently than the urologist. The reason for this is quite apparent. The disease at the onset so often simulates acute surgical abdominal catastrophies, especially when the symptoms point to the right side, that the case is sent to the general surgeon as acute retrocecal appendicitis, acute cholecystitis, acute pancreatitis, perforating duodenal or gastric ulcer, or liver abscess. Thus we see that the abdominal surgeon is likely to encounter this acute malady more often than the urologist. When sent to the urologist the disease already shows marked urinary symptoms and has progressed beyond the acute stage, and the sequellae caused by the extensive suppuration is evident. If one bears in mind the pathognomonic sign of costovertebral tenderness, the Murphy percussion sign, the urinary findings on cystoscopy in addition to a carefully elicited history in cases of acute unilateral hematogenous infection of the kidney, the difficulty of differential diagnosis from the numerous acute surgical abdominal conditions will be considerably diminished. The object of the quotation of

record of the comparatively large number of cases of this ailment treated at a single hospital of this city was to emphasize the frequency of occurrence of these cases, and the ability to diagnosticate the condition in its incipiency, if we bear in mind that acute hematogenous infection of the kidney does occur and is often confounded with acute intraperitoneal conditions.

CONCLUSION

A few words on the treatment of this disease. There are mild cases of this condition that may be treated palliatively and result in apparent recovery. One must, however, be on guard to recognize that some of these mild cases may recur and require surgical treatment. The palliative treatment consists of rest in bed, forcing fluids, administration of urotropine and general constitutional treatment. As a rule however, the great majority of these cases are not amenable to medical treatment and ultimately require surgical interference.

The surgical treatment of kidney infection presents a much more difficult problem at the operating table than infections of the gall bladder or appendix. The surgical procedure indicated will largely depend on the extent of suppuration, and the location of the lesions. The presence of a second kidney, its functional ability and freedom from disease must unquestionably be established before operation.

The surgeon has the choice of nephrectomy, partial nephrectomy, decapsulation, incision and drainage and nephrotomy in effecting a cure. We can formulate no absolute rules as to which choice shall prevail. The operation must depend on: *a.* the pathology found on exposure of the kidney. *b.* The condition of the second kidney. *c.* The general status of the patient.

If the patient is critically ill with severe toxemia and high temperature and if, on exposure of the kidney, we see extensive destruction of the organ, nephrectomy is indicated when the presence of a second

kidney has been established. In these cases procrastination spells failure.

In the so-called fulminating types of acute unilateral hematogenous infection of the kidney prompt nephrectomy is invariably our only hope of salvation.

The writer is unalterably opposed to nephrotomy as a curative procedure in this type of disease. My experience coincides with that of Dr. Brewer. The results of this operation have too often proved fatal to warrant its further continuance. The splitting of the kidney in all probability carries the highly infective pus from the diseased cortex to the unaffected medulla.

In the majority of my acute cases I have found that where there are few, or numerous small cortical or subcapsular abscesses, as is most often the case in acute unilateral hematogenous infection of the kidney, *decapsulation* is the operation of choice. The results have been excellent. In my series of 22 cases of acute unilateral hematogenous infection of the kidney where decapsulation was performed, 21 made complete uneventful recoveries. The convalescence was mild and of short duration as a rule. The one fatality of this series was complicated by lobar pneumonia.

When the condition of the second kidney is at all dubious we can readily see why the operation is of extreme advantage. The rationale of decapsulation is quite obvious. We have an enlarged, tender and painful organ studded with numerous foci of pus and enclosed in a tight-fitting fibrous capsule. Pus under tension in any part of the body is painful and dangerous, and doubly so in an organ so well encased in an unyielding capsule as the kidney. Release from its encasement and proper drainage will often suffice to cure this type of kidney infection. Rarely is secondary nephrectomy necessary after decapsulation.

When suppuration has extended through the capsule of the kidney into the fatty tissues, we have a perinephritis, or perinephritic abscess. Here we might say that nature has performed a partial decapsula-

tion to relieve tension by causing a rupture of the capsule. The establishment of proper drainage will often affect a cure.

Permit me in closing to stress again the importance of early diagnosis and prompt institution of the proper treatment in acute hematogeneous infections of the kidney. For the physician to apply poultices over an infected kidney whose cortex is studded with miliary abscesses and wait for the formation of a perinephritic abscess as the proper time for establishing drainage is about as logical as to delay operation in cases of acute osteomyelitis until the pus has perforated and formed a superficial fluctuating mass under the skin.

USE OF THE TENNIS FORCEPS IN CHOLECYSTECTOMY*

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DURING the course of my operative work, I have been particularly interested in the technique of cholecystectomy. Any unnecessary delay in the operation is harmful to the patient and it seems expedient to analyze methods and means to shorten the operation without curtailing the essentials of good technique. The ordinary procedure of cholecystectomy may be divided into three parts: First, freeing of the gall bladder from its liver attachments; second, tying of the cystic artery and the cystic duct; third, the attention directed toward the stump of the cystic duct and repair of the gall-bladder bed. In addition thereto, one must take into consideration the careful examination and exploration of the gall-bladder tracts, particularly the ductus choledochus and papillae of Vater. Every care must be exercised in this connection because of the not infrequent postoperative colics encountered due to concretions, strictures of the ductus choledochus and spastic contracture to the sphincter of Oddi. Whether or not the duct should be sounded during the operation is debatable. While on the one hand the possibility of strictures arise if the ductus choledochus is opened and drained, others insist on such exploration with every suspicion of stones. One can, of course, draw certain conclusions from the condition of the gall bladder itself. If one finds, for example, one or several large concretions, and if the patient has never had icterus, the possibility of concretions in the ductus choledochus is rare. If the ductus choledochus is normal in size and circumference and if one can squeeze bile into the duodenum (after removing the stone), I believe one need not open the ductus choledochus. Careful examination is, however, necessary because with ordinary palpation the stone is by no means always determined. It is this manipulation necessary for careful examination which is made easier by the method I shall describe.

Operations on the bile tracts with manipulation of the liver and the associated vascular and ·respiratory disturbances make considerable demands on the patient, particularly when resistance has been reduced by a chronic process; such conditions naturally demand rapid operative technique. In consideration of these requirements, I believe that various stages of the operative technique can be simplified without impairing the safety of the procedure. As a prerequisite, however, it is assumed that one is dealing with the cholecystitis which has not yet produced marked autonomical alterations of the gall bladder or the adjacent viscera.

After the preliminary orientation of the operative field following the incision (without direct manipulation of the field), decision is reached whether the gall bladder is to be extirpated, and if so, whether it can be freed from the back; or whether a dissection of the gall-bladder tracts is to be made (which may not be necessary in the case of an "Otomy").

In order to free the gall bladder from the liver bed the thumb and the index finger of the left hand grasp the neck of the gall bladder just where it leaves the liver bed and, surrounded by thin tissue and fat of the ligamentum hepatoduodenale, enters into the ductus cysticus. In the drawing this point is indicated with an arrow. The neck of the gall bladder is pulled over laterally in the direction of the arrow, the peritoneum is stretched and can be easily penetrated with the index finger. The finger now being subserous and behind the gall bladder (in other words, between the liver bed and gall bladder), it is usually easy to separate the gall bladder by section backward.

In some inflammatory conditions the

serosa covering the lateral wall of the gall bladder must occasionally be split by instrument. On the medial side one can usually dissect bluntly up to the fundus. Thus the freeing of the gall bladder is done very rapidly, and one does well to proceed immediately to the tying off and removal (the second phase) of the gall bladder.

The gall bladder, attached now only by the ductus cysticus and arteria cystica, the tennis forceps is now clamped over them. This instrument is so constructed that even the enlarged gall bladder goes through one of the blades and the forceps can then be clamped over the neck of the gall bladder when it is held somewhat in tension. The ductus cysticus and the arteria cystica now being clamped, the gall bladder itself is free between the branches of the tennis clamp. Now a curved forceps is used to clamp off the gall bladder and the stump is severed between the two forceps.

The duct and the artery can be ligated together if no sounding of the duct is contemplated. The ligature ties very easily about the curved pole of the tennis forceps. If, however, further exploration is considered necessary, the broad sweep of the forceps aids materially in visualization. Duct and artery can readily be separated and examined individually. Of course, if the ductus choledochus is to be opened, the ductus cysticus is first tied off.

Preparation of bed and stump follow. In 1924 Korte wrote: "There are altogether too many artifices in the technique of handling the cystic duct. Ligature with the catgut, covering with adjacent peritoneum or ligamentum teres is sufficient. The same holds true for the liver bed."

As a matter of fact one can get along with very little. When the liver is permitted to drop back into its normal position, the cystic duct falls into the bed of surrounding connective tissue and fatty membranes which completely enclose it and make peritonealization superfluous. We some-

times forget that the portal picture to which we are accustomed when we turn up the liver for surgery is far from the
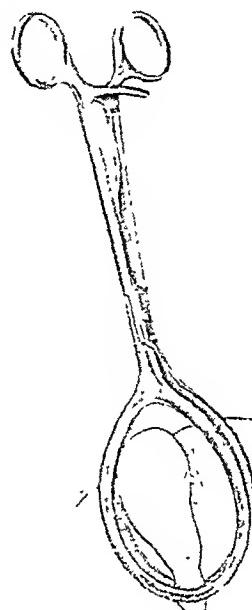
Fig. 1.

normal. I consider it most likely that with complicated surgical repair, with many catgut sutures etc., definite distortion of the tracts may ensue that may later give rise to symptoms. I content myself with one or two stitches at the most, approximating the split layers of the ligamentum hepatoduodenale; even these may at times be omitted.

In repairing the bed of the gall bladder, it is not always possible to bring together the two layers of the serosa and then it is actually sufficient to leave the bed as it is, after the bleeding has been stopped. Hemostasis is here materially aided by the use of the catgut tampon which I have described in another article.[1] A thin rubber drain approximately corresponding to a catheter from 22–24 Char is placed into the bed of the gall bladder and reaches to the region of the cystic stump. This I leave in for three or four days until no further secretion is forthcoming.

[1] Kümmell, Hermann. Resorbable Tampon. Am. J. Surg. In Press.

ENTEROSTOMY WITH THE FENESTRATED T TUBE*

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I N this paper I shall not go into the indications for the employment of an enterostomy.

Assuming that you have an adynamic ileus, and that you wish to do a jejunostomy, success in this form of treatment depends upon the carrying out of a technique which is simple, quick and safe, to be followed by a postoperative technique concerned in the thorough evacuation of the septic contents of the intestine. The use of the fenestrated T tube with the technique I shall describe will meet the above desiderata.

For about ten years I have been employing a T tube as an enterostomy tube, modified from the T tube in common surgical use as a common bile duct drainage-tube. I was led to adopt this tube through having an emergency enterostomy to do, and finding that my only immediately available tube was one of these T tubes.

The T tubes come in four sizes: small, medium, large and extra large, corresponding to French catheter sizes 20, 26, 30 and 32. I have used for enterostomy the medium and large sizes. The rubber must be firm, medium heavy, not too flexible but still more or less pliable. This necessity will become apparent in the description of the technique where, by traction on the stem of the tube the intestine is pulled snugly up against the parietal peritoneum and the outer bowel wall is held in this close approximation. The head of the tube is about 3½ inches long and the stem is about 10 to 12 in. long. The tube is modified by fenestra (generally three), one larger, over the site of the junction of the head with the stem, one smaller, on either side of this; so that the head of the T tube within the intestine has five openings: two at the ends and three on the upper surface.

A vertical incision is made to the left of the umbilicus (or elsewhere if desired), through the outer portion (not border) of the rectus. The depth of the muscle on either side of an enterostomy later facilitates early closure of the fistula. When the fascial plane overlying the peritoneum is reached, make this part of the incision as short as possible, to the delivery of a loop of intestine far enough out of the abdominal cavity to make the enterostomy. A sizable loop of jejunum of ileum may be delivered through a fascial incision not much over an inch in length. Bowel clamps with rubber tube covering, or the fingers of an assistant, are applied about 5 inches apart, after stripping this segment empty.

There is no need even to know which is the proximal and which the distal end of the loop delivered, because the tube is identical in either of its longitudinal extensions within the bowel. After the small fascial incision is made the first (distended) loop seen is hooked up into the incision. A small incision is made transversely through the coats of the intestine. One end of the head of the tube is passed in one direction into the bowel nearly to the junction, but not quite; the other end is passed into the bowel in the opposite direction. While this is being done, either margin of the bowel incision is in the grasp of a locked tissue forceps and the tube is fully introduced. A pursestring suture of No. 2 catgut is passed around the incision in the bowel and drawn very snugly about the tube and tied. No

other suture connected with the tube or the enterostomy (proper) is applied to the peritoneum, intestine or fascia.

The bowel being insinuated back into the abdomen, one or two sutures are put on either side in the fascia. Perhaps the greatest advantage of this T tube now comes into play. The intestine at the site of the enterostomy, owing to the secure hold of the tube in the bowel, can be very closely approximated to the parietal peritoneum, by rather forceful traction on the stem. It will in no sense injure the bowel by pressure necrosis, on account of the flexibility of both ends of the tube in the bowel. The pull comes at the site of the enterostomy. When the intestine is pulled snugly up into place by traction on the stem, a heavy silkworm gut suture, with a deep bite of the needle, on one side, fastens the tube to the skin and holds the intestine snugly up in place. There can be no possible leakage around the tube in the abdomen, at the enterostomy site; for within twenty-four hours the abdomen will be shut off from adhesions. The silkworm gut in the skin makes it "fool proof" because nothing but willful and excessive traction could pull the tube away from the skin and out of the intestine. This makes a sure guard against accidents. To be doubly certain, another silkworm gut suture may be put through the skin and tube on the other side of the incision.

Next one should suture the incision, muscles and skin, in any manner, and by means of a glass connecting tube connect the end of the stem of the tube with a section of rubber tubing. Douche-can tubing is generally used. A pint bottle is hung low on the side (either side) of the bed and the end of the tube inserted into this bottle. After the tube starts draining well, this acts as a syphon and supplements peristalsis and intra-abdominal pressure. The small bottle has many advantages. It can be inspected at all times and emptied frequently and changes in the quantity and quality of the discharge readily noted. There will generally be no leakage around the tube for three or four days until the function of the bowel has returned either of its own volition or by help from low enemas. The tube need not be removed as soon as leakage starts and may be left in a week or even longer, but it is a better plan to remove it after there is considerable leakage around the tube. There is no trouble whatever in removing the tube. It may come a little hard but there is no harm in using any force necessary to bring about its removal. At the time of the withdrawal of the tube the enterostomy (stoma) is patulous, easily dilatable, and firmly adherent around the margin, hence strong traction on the stem causes the head to fold at the large fenestrum · and the tube comes readily away after the silkworm gut suture is severed.

It is of the utmost importance to evacuate the septic contents of the intestine as soon as possible. This can be readily accomplished by lavage in this manner: Disconnect the stem of the tube from the rubber tubing, and raise it to a vertical position. Insert the end of a funnel into the open end of the stem, pour in normal saline or sodium bicarbonate solution, and fill the intestine to capacity or tolerance. Then depress the end of the stem as low as possible and syphon the fluid off. For one course of lavage repeat two or three times. Repeat the lavage at hourly intervals if necessary. If the tube is draining profusely lavage can be dispensed with, unless the enterostomy is a preliminary operation; in which case it is imperative to empty the bowel by frequent courses of lavage.

Early closure of the fistula and prevention of the dermatosis resulting from drainage onto the skin could be most easily brought about by following the plan of Dr. C. H. Mayo, which consists of making a perforation through the omentum, and bringing the stem of the enterostomy tube through this perforation. The drainage stops almost immediately after withdrawal of the tube. If the omentum were readily available through

the small fascial incision, and there were no need to explore, handle the intestines and consume time, this would be the greatest advantage, providing that, at the time of withdrawal of the tube obstructive symptoms were entirely lacking and the patient in a fair way toward recovery. In the ordinary case one will see only in the site of the small fascial incision a distended loop of the bowel, and it would seem, on the whole, the better plan partly to deliver it and complete the enterostomy.

The introduction through the enterostomy tube of normal saline or bicarbonate solution greatly facilitates syphonage. If *the tube stops draining, fill the intestine* with fluid. The tube offers great advantages in doing this. A large (one-piece, ball and nozzle) soft rubber syringe, known as an "ear and ulcer" syringe, whose nozzle fits closely into the open end of the stem of the tube, when filled with fluid, can be used to dislodge anything plugging up the tube.

The advantages gained in the use of this fenestrated T tube are several: Where a mushroom catheter or glass test-tube is employed, irrigation and lavage are interfered with and syphonage stopped by the opposite wall of the lumen of the bowel "sucking into" the mouth of the apparatus; whereas the multiple openings in the head of the tube make this physically impossible and the continuity of the tube into long tubing makes a true syphon of it.

A leading surgeon informs me that the intestines and peritoneal cavity are less disturbed or traumatized by the method described in this paper than by any other method he knows of, because of the "marsupialization" immediately produced by this technique with the fenestrated T tube. Less harm potentially occurs following its use.

The tube stays "right in the place it is put." If the rubber were too soft the free ends would curl or bend up into the lumen of the bowel. If the tube were too rigid the free ends of the head of the T tube in the bowel would exert undue pressure by strong traction on the stem, whereas there is enough pliability of the rubber of this tube to avoid that. The strong pressure comes only at the site of the stoma which is either advantageous or negligible. The simplicity, relative safety and speedy accomplishment of this technique are potent advantages in the use of this tube.

CONGENITAL DISLOCATION OF THE HIP JOINT[*]

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ORIGIN AND DEVELOPMENT OF METHODS OF TREATMENT

THE status of congenital dislocation of the hip in medical practice about 1895 is reflected in the late Virgil P. Gibney's contribution to Denis's System of Surgery:[1]

"This is a deformity for which very little has been done in the way of mechanical appliances. It is true that there are a few cases on record wherein long persistence in the use of traction and reposition of the limb has resulted in what seems to be a permanent reduction of the deformity. The very nature of it would seem to be an insuperable obstacle to a cure by mechanical devices."

At about the time the above was written, two methods of treatment were proposed, which, with or without modifications and amplifications, from the basis of present-day treatment.

The first of these, the open method of Hoffa, consisted in the exposure of the joint, reaming out an acetabulum and reducing the head of the femur into it. Considerable grief was associated with the earlier experience of this method due, in part, to the general state of the operative surgery of that time. It had its proper application then as now, to the palliation of what might be termed "over age" cases, that is, those in which much incongruity of joint elements had taken place, due to long standing dislocation. It is still, despite the greatly lessened hazards of shock, infection, and permanent joint stiffness, the basis of operative procedures for these cases.

One important exception to the above as it concerns the open method of treatment must be noted. It has recently been advocated that open operation be done in all cases. The most prominent exponent of this policy and practice is Galloway.[2] This view has not to the present time found wide acceptance.

The second basic method of treatment to be proposed was the closed or bloodless method of Lorenz. Here was pointed out not only the possibility of closed reduction of the dislocation, a matter which had here and there[3] been accomplished before, particularly by Paci, but what was much more important, a method of maintaining the reduction. The method met with enthusiastic and widespread acceptance.

The Lorenz method of treatment was the first which took into account the natural adaptability of structure to function. Since this adaptability is greatest in infancy, and since the incongruity of the joint elements is less the more recent the dislocation, it is not surprising that the accumulated experience has shown that the most complete results and the highest percentage of successes have followed treatment at an early age.

A prodigious wealth of literature on congenital dislocation of the hip has accumulated in the last thirty years. If it be borne in mind that an immediate result requires a time period of from six to twelve months to evaluate, and that evaluation of an ultimate result requires a longer period, it is not difficult to appreciate that a great deal of the early collateral literature and much of the later literature must be carefully interpreted in order that it may have a constructive bearing.

THE RÔLE OF THE ASSOCIATED ANTERIOR DISTORTION OF THE UPPER END OF THE FEMUR

The observation that the femur is structurally altered in the sense that its head and neck are directed more or less forward instead of in the frontal plane has been frequently made, and is a common finding at open operations for congenital dislocation. Its invariable presence is indicated in the roentgen rays of congenitally dislocated hips. If an exposure be made in the usual manner with the patella directed forward, the head and neck of the femur will appear greatly shortened, almost superimposed upon the upper end of the shaft. If a second exposure be made with the extremity rotated inwardly, an adequate neck and head will be displayed.

The mechanism of the production of this anterior distortion would seem to be as follows:

Congenital dislocation of the hip is a gradual process. The primary displacement is anterolateral, accomplished usually under the stress of weight-bearing and hence usually not recognizable until ambulation begins.

The secondary displacement is frankly lateral, when the head of the femur may be felt beneath the anterior superior spine. Upon flexion of the thigh the head may be felt posteriorly.

The complete dislocation of the head upon the dorsum of the ilium is the terminal stage. Here the head is no longer palpable anteriorly.

The time relations of these displacements are exceedingly variable except that it may be noted that the dislocation rarely progresses to the terminal stage before the completion of the third year.

The infantile femur presents a rather moderate normal forward inclination of the neck and head. In the presence of dislocation this normal forward inclination becomes accentuated under the stress of function by contact of the head of the femur with the side of the ilium.

If the dislocation be treated without regard to the anterior distortion the head tends to slip forward and laterally, thus reproducing one of the earlier phases of the dislocation.

The adaptive structural changes which take place in the joint after reduction of the dislocation are the foundation upon which treatment is based. Acquired structural changes should be remedied to the last degree possible by artificial means in order that the adaptive processes of nature may be exercised most favorably. The more or less deficient acetabulum is substantially not amenable to artificial reconstruction in the age group of cases here under discussion. The structural deformity of the femur descirbed above, in which its upper end has undergone an anterior twist, imposes an entirely gratuitous burden upon the development of the reduced hip. This structural deformity of the femur may be corrected by the following simple and harmless method:

STANDARDIZATION OF CLOSED METHOD OF TREATMENT OF DISLOCATION. AUTHOR'S PROCEDURE FOR CORRECTION OF ANTERIOR DISTORTION BY CLOSED METHOD

The historical precedents for the correction of anterior distortion have been covered in the writer's earlier paper.[4] The present method is a modification and an adaptation of several earlier methods. It has the advantage of ease and reasonable accuracy of performance, and of being fitted into a definite scheme of treatment of the dislocation as a whole.

The closed method of treatment has its application up to the age of three years. The longer the hip is allowed to remain dislocated, the greater are the secondary changes. Cases reporting for primary treatment after that age should be put down as instances of professional or parental neglect, since in general only a partial result can be attained by any method of treatment.

The reduction of the dislocation in this age group is accomplished manually with a minimum trauma. If the child is pre-

sented for treatment before sphincteric control is established, reduction is postponed until this has been attained.
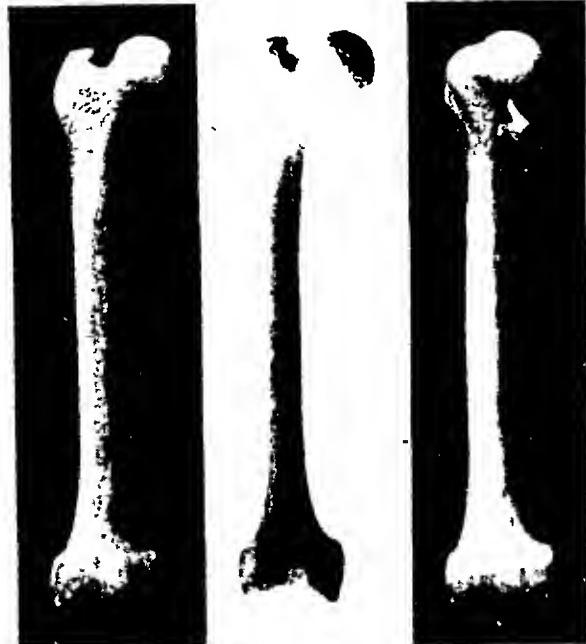
Fig. 1. Specimen femora illustrating anterior distortion. (From Lange's "Lehrbuch der Orthopadie.")

At the first sitting the dislocation is reduced and fixed in a plaster of Paris

Fig. 3. Roentgenogram after reduction, showing the first attitude.

spica in the original 90–90° attitude of Lorenz, except that the dressing is carried

below the knee. This attitude is maintained for two weeks.

At the second sitting, two weeks later,
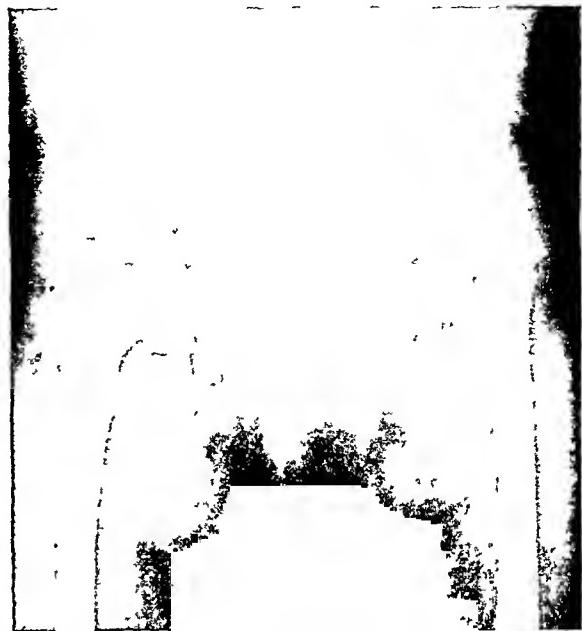
Fig. 2. Pre-operative roentgenogram. C. G., Aged two. Congenital dislocation of the right hip, with marked anterior distortion of the femur.

the anterior distortion is evaluated by a study of the roentgenograms made before
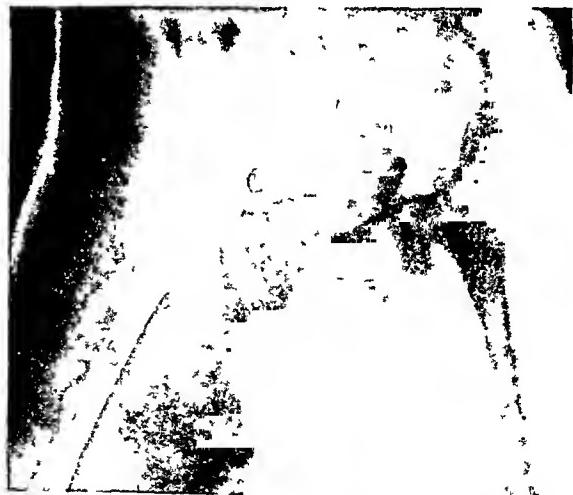
Fig. 4. Second sitting. The hip has been fully rotated inward, and the hip joint elements are in an approximately physiological attitude.

reduction, but particularly by the evaluation of what may be gained by palpation of the hip-joint structures. The abduction is carefully reduced to about 25° or 30°

and the patella is brought into the sagittal plane. If the head remains deeply placed in the tissues of the groin, and in its proper

Fig 5. Third sitting. The femur has been fractured manually in the supracondylar region. Roentgenogram indicates the jagged character of the fracture produced by this means

relation beneath the femoral artery, it may be assumed that no abnormal anterior distortion is present. The limb is then fixed in this attitude, which attitude is maintained until the end of the period of fixation treatment, and no third sitting is required. If, on the contrary, it be found that in this attitude the head of the femur becomes prominent in the groin, and if upon even slight outward rotation of the extremity it becomes displaced slightly laterally to the line of the femoral artery, it may be assumed that a degree of anterior distortion exists which is inimical to the ultimate security of the joint. In those cases in which such a state of affairs is found to be present, the extremity is rotated inwardly to a degree sufficient to place the head deeply into the groin and in

its proper relation to the line of the femoral artery. The amount of energy expended in this manipulation need not be small, since
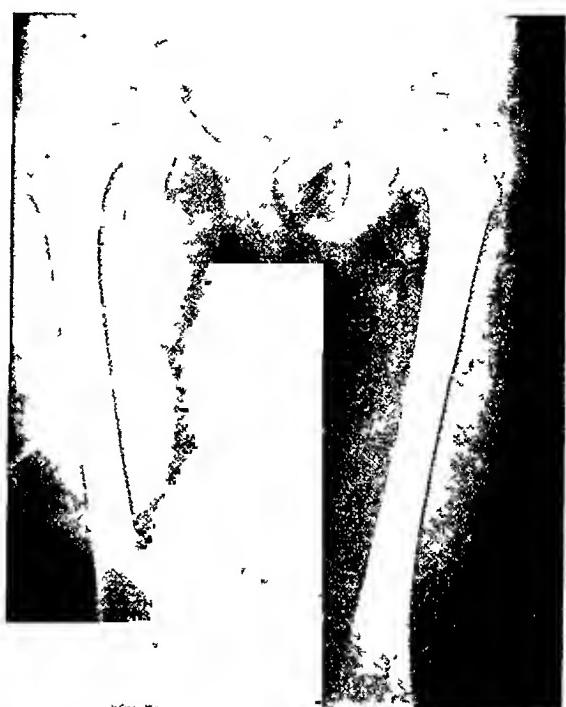
Fig. 6. Roentgenogram one year after the removal of fixation dressings Period of fixation in this case, six months

there is at this time no danger of dislocation over the posterior rim of the acetabulum. A plaster of Paris spica is applied in the corrected attitude, an attitude in which the hip-joint elements are in approximately physiological relations, or at least one from which such relations may be attained without further basic alteration. This fixation dressing is designed to remain in place for three months.

Third sitting. This is required only in those cases in which as above outlined, it has been found necessary to impose inward rotation upon the extremity. The imposition of the necessary degree of inward rotation demands that a correction of this secondary distortion be made, since upon release from fixation dressings the head of the femur would be levered forward as soon as an attitude consistent with progression was assumed.

At this sitting, upon removal of the

plaster, the extremity lies as it were upon its inner side, with the knee flexed. The knee is grasped with one hand and the shaft of the femur adjacent to it with the other, and a fracture is produced in the supracondylar region by manual force. This fracture invariably occurs in the segment above the epiphyseal line, a fact originally pointed out by Brandes.[5] The fracture is completed and then one hand grasps the head and neck of the femur, the other the flexed knee joint. Outward rotation of the lower fragment is made, the upper hand maintaining the original relation of the head and neck at the hip joint. The lower fragment is rotated outwardly until the patella lies outside the sagittal plane. A plaster of Paris spica is applied in the corrected attitude, in about 20° of abduction and slight flexion at the hip and knee joints.

This plaster is designed to remain on for two months, thus giving, in the ideal case, a period of fixation of somewhat less than six months. During the last month of fixation treatment, the patient is to stand and make attempts at ambulation in so far as that may be possible.

RESULTS

The present paper is not designed as a study of end-results, but rather as a relation of experience. In this age group up to three years 46 dislocated hip joints have presented during the last three years on the First Surgical Division of this hospital. Of these 15 are still in fixation dressings. The correction of anterior distortion was done 24 times. One patient (two hips) died of intercurrent disease (tuberculous meningitis) while in fixation dressings. One hip was irreducible and required open operation with subsequent correction of anterior distortion. One hip redislocated anteriorly after the correction of anterior distortion, and is now in fixation dressings. To counterbalance this one hip which had redislocated following the "classical" (Lorenz) treatment is in place on year after reposition and correction of rotation. Of

31 hips released from fixation dressings 2 of which (one case) died of intercurrent disease, 28 may be considered to be satisfactory results, in periods of observation up to two years. Minor deviations from the anatomically normal hip must be evaluated at a much later time.

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DISCUSSION

Dr. Russell A. Hibbs. Dr. Hibbs said he was very much interested in Doctor Krida's paper as he thought he had called attention to one of the great difficulties in securing good results in congenital dislocation, namely torsion of the femur. He felt that if correcting the distortion is as successful as it appears to be in Doctor Krida's hands it is simplified a great deal. The method Dr. Hibbs has used has been open operation, osteotomy of the femur at the junction of the lower and middle third. The object is to correct the deformity and if Doctor Krida can do that accurately with this method, as he appears to, it seems simpler than to do an open operation. Doctor Hibbs was impressed with the amount of force it seemingly takes in the movie film to fracture a child's femur and secondly the danger of that force in its effect on the reduced hip, but he said the proof of all that is, of course, Doctor Krida's experience; and we all must realize we are a long way from the solution of the problem of congenital dislocation. There has been in the past a great deal more enthusiasm for closed reduction, but this enthusiasm has been much diminished by study made of end-results as these results have been very disappointing. Cases which have for a short period of time after reduction seemed very good have in adult life shown that there had been a degree of traumatism done of which there was no realization at the time of operation. Doctor

Hibbs recently had an interesting case at the hospital where someone attempted to reduce the hip of a child of three years by very gentle manipulation; the hip was opened immediately afterwards and the joint found filled with blood, showing the amount of traumatism that was done to the child's hip. As to open and closed operation in all cases, he thought that a debatable question. He has for a long time been very enthusiastically devoted to the closed method, but is now inclined to feel that a great many more hips should be subjected to open operation than have been in the past. In cases which cannot be reduced, and there are a certain number, the good operator will do less traumatism in the hip by open than by the closed method. Doctor Hibbs is at present doing more open operations but is not in a position yet to make a comparison with the closed method; he is going to study both methods over a longer period of time and when that study is completed will report all the cases he has done and, so far as he can, estimate their results.

DR. SAMUEL W. BOORSTEIN had had the pleasure of seeing Dr. Krida doing these operations and thought the little amount of force required was surprising. He felt it is probably easy to break these bones after they have been in plaster for so long a time as the bones are then atrophied.

Dr. Boorstein was always interested to find out why some of these hips slipped out, especially at the change of the first plaster. Ordinarily fractures are reduced under the fluoroscope in the x-ray room. The same method can be used in hip dislocation that is, they are reduced in the x-ray room on the x-ray table. He was afraid to use the fluoroscope during the reduction because he didn't want to take a chance with his hands. Doctor Boorstein reduces the hips and takes a roentgenogram while the child is under ether and held by an assistant. In eight minutes the roentgenogram is developed and read. If found satisfactory, plaster spica is applied and another roentgenogram taken. He also found that in many of these cases while trying to change the first position the hips slipped out easily. He thinks it best to determine what position is desired, hold the hip in that position, take roentgenograms in two or three positions, read the plate wet, find the position which is safe, put it in that position and have another roentgenogram taken

for permanent record. When Dr. Boorstein saw Dr. Krida's method, he thought that if that would be done in the x-ray room it would be safer to see whether the hip didn't slip out while manipulating the knee. He felt Dr. Krida was perhaps more certain of his hands than he was because he could not be certain the hip would not slip out. Dr. Boorstein also thinks a roentgenogram should be taken before putting on the plaster to determine definitely the position of the head and the position of the lower fragments of the femur.

He found many times that when the reduced hip is put in plaster and seems to be very firm, a few weeks later the plaster is loose. This may cause slipping out of the hip. He thought this could be avoided by use of the method used in scoliosis where we usually put in felt pads over the convex part to push it forward. He suggests using a pad 4×4 and $1''$ thick, on the buttock over the dislocated hip; two weeks later when this has loosened put another pad on and the hip will not be pushed back; on the contrary it helps to push the head forward. Dr. Boorstein thinks some men keep the plaster on too long. He knew men in Montreal who kept them on for six weeks altogether and allowed them to run freely. This is perhaps too short a time. He himself changes the first plaster after eight weeks.

DR. ROYAL WHITMAN said it has been demonstrated by several investigators that the anterior inclination of the neck of the femur is greater in the fetus than at birth, and greater at birth than in adult life.

It may be assumed therefore that in congenital dislocation, the corrective process being checked, it is as a rule greater than in a normal subject. It has been asserted that anterior torsion has little influence on the result because it is corrected in part by the tension on the neck of the primary Lorenz position. This may be true of a certain proportion of the cases, but on the other hand there is little doubt but that the distortion is the most important factor in the failure of manipulative reduction. In past years the results of operative correction of the anterior torsion by osteotomy or osteoclasis, usually in older subjects, as a supplement to open or manipulative reduction, have been, generally speaking, unsatisfactory. Correction of the deformity by manual osteoclasis as a part of manipulative reduction has been carried out by several surgeons, notably

Froelich and Brandes, but the routine advocated by Dr. Krida is a practical advance because the diagnosis is established at the first examination, and the deformity is corrected at a later period, irrespective of the apparent security of the reduction.

This may be unnecessary in certain cases but it involves practically no risk or additional discomfort, and as an additional assurance of success it should be accepted as a part of the ordinary routine.

Dr. Leo Mayer asked why Dr. Krida considered it advantageous to put the leg up in the internal rotation position afterward and not at first.

Dr. Samuel Kleinberg has watched Dr. Krida work for several years and has been impressed and instructed by his observations. There is no question in his mind that the method as outlined for the management of cases of congenital dislocation of the hip with anterior torsion of the neck is an excellent one. Dr. Hibbs mentioned that there appeared to be considerable force used in the fracture of the femur. Dr. Kleinberg thinks that the pictures exaggerate the manipulation. Dr. Krida has demonstrated that the atrophy of the femur is so great that comparatively little force is necessary to fracture the femur, and only moderate force to twist the lower fragment outward. The most important point is that this procedure is particularly applicable to those cases in which there is an anterior twist of the femoral neck. We know that there are many cases that can be cured completely by the older method of reduction by manual force and application of a plaster spica without the use of fracture of the femur. In those cases where there is more or less distortion of the anterior neck we have reason to anticipate a subsequent subluxation or anterior displacement when we use the older method. For this type of case Dr. Krida's method of treatment is superior to all others. As far as the ultimate effect on the appearance and the morphology of the hip is concerned, Dr. Kleinberg doesn't know whether there will be any less deforming influence from this method than from the others.

It is possible that even with this method we may be disappointed, just as Dr. Hibbs was, and find that cases which have apparently done very well return several years later and show distortion of the head and irregularity of

the acetabulum. He said he did not know how to prevent the morphological disturbances of the hip. Dr. Lippman of Mount Sinai Hospital is at present carrying on experiments on the circulation of the hip joint and may, we hope, throw light on this phase of hip-joint changes. It has been Dr. Kleinberg's experience that in those cases in which one could not reduce the dislocation by moderate force, an open operation revealed the capsule thoroughly adherent to the acetabulum, absolutely blocking manipulative reduction. In such cases no type of "closed method" can bring the head of the femur into the acetabulum. Dr. Kleinberg also seen cases where the acetabulum was but a mere indentation and could not hold the femoral head. Evidently, therefore, no one method can be used for all cases. But from the observation of the cases treated at the Hospital for Ruptured and Crippled, Dr. Kleinberg was convinced that Dr. Krida's method was eminently successful, and constituted the best procedure for those cases of congenital dislocation of the hip in which there was anterior torsion of the femoral neck.

Dr. Reginald H. Sayre thought Doctor Krida had presented a very intelligent method of treating these cases. It brought to his mind a conversation he had with Dr. Lorenz when he was here. He had a number of cases for Dr. Lorenz to operate on at the college and he selected a little girl eight years old with an anterior twist to the head of the femur. Dr. Lorenz said he would not attempt to put that head into the acetabulum; instead he placed it under the anterior inferior spine of the ilium and thought she would do very well. Dr. Lorenz said he had had an illustration of this a few years before. A young daughter of an army officer had a double congenital dislocation of the hip and Schede of Hamburg had put them back in place. After a year when the heads of the femurs were nicely in the acetabula the child's toes were inverted. Schede said now that it had healed he would do an osteotomy in the lower end of the femur to turn the toes forward. The family then called Dr. Lorenz, of Vienna and he dislocated the femur and flopped its head around in front of the acetabulum under the anterior inferior spine. The family and Lorenz were happy; everybody was pleased except Schede. This seemed to Dr. Sayre such an extraordinary statement he could hardly credit his ears. Dr. Lorenz treated this little

girl in Dr. Sayre's clinic in exactly the same way, because it is better than doing an osteotomy and turning the toes around later on. Dr. Royal Whitman was the first one to suggest this intelligent way of doing this thing in this country. In this particular case Dr. Lorenz said it was better to leave the joint locked up nine months before taking it down. When Dr. Sayre took it down he had great difficulty in getting the foot around in a decent position. He particularly wanted this case to be a good result for Dr. Lorenz, so he worked for many months with manipulations and twistings and turnings and eventually the girl got absolutely well. She is not of course anatomically well; the hip is all wrong and the head of the femur not in the acetabulum at all, but she runs up and down stairs without a limp. Dr. Sayre took the girl before his class and the students could not tell whether the right or left side had been dislocated. It was an absolutely perfect recovery.

Dr. Sayre said he believed this is not the intelligent way to treat these cases and that the method Doctor Krida suggested is infinitely more in line with rational medicine. The fact that those bones break so easily, as Dr. Boorstein said, was probably due to being locked in plaster of Paris. Dr. Sayre thinks the lime will be absorbed under rest. He has heard several men say if one found the hip was not in best position and wanted to replace it it should be left out of plaster of Paris for a couple of weeks, or else one is likely to fracture the neck or the head.

Dr. George Anopol said that the open method has a greater appeal to him; that it is easier, more definite, causes less trauma to soft tissue, and brings about earlier and more satisfactory motion as with cases of the knee after damage has been done to the soft tissues in the supracondylar region. This particular series has brought out one phase of dislocation of the hip, the torsion of upper end of femur, one of the deformities that is not so easily reduced. In too many cases reduction is attempted without sufficiently accurate diagnosis as to the relationship of the head to the acetabulum.

Dr. Krida in closing the discussion said that he was pleased with the generally sympathetic tone of the remarks of those who discussed the paper. He was particularly interested in the question of the accuracy of the correction which Dr. Hibbs raised, and stated in reply that inasmuch as there was no mathematically accurate method of measuring anterior distortion, the accuracy of its correction is limited by that same consideration. He felt that in none of his cases was the correction overdone. He felt that the closed osteoclasis presented this distinct advantage over open osteotomy, that the fracture produced is rough, jagged and irregular, with no tendency to displacement such as exists after a clean chisel cut.

In the age group up to three years, it has been found in this series that reduction could be made with little force. He stated that the day of repeated attempts at closed reduction was past. The open operation should involve less traumatism than repeated closed attempts at reduction.

The amount of force necessary to fracture the femur manually is not great. The point was covered in Dr. Kleinberg's remarks. The bones are quite soft after residence in plaster. There is no danger of reproducing the dislocation of the hip.

In reply to Dr. Boorstein, Dr. Krida stated that there had been no redislocation in plaster since he had used a very lightly padded, closely molded, thin plaster. Roentgenograms in these cases were made the following day.

In reply to Dr. Mayer's question as to why the attitude of internal rotation was not adopted at the time of reduction, rather than at a separate sitting two weeks later, Dr. Krida stated that he felt that the 90°-90° position, in addition to entirely overcoming the adductor contraction, assured against the possibility of an immediate redislocation and gave the tissues at the back of the joint an opportunity for a certain amount of contraction. It was also much easier at the second sitting to feel the conformation of the head and neck.

Dr. Kleinberg discussed the impossibility of closed reduction in certain cases, and Dr. Krida felt that this was intimately associated with the duration of the dislocation. The age group here reported was up to the age of three years, and in none of these was there any difficulty in closed reduction. He could not see that our attitude toward congenital dislocation should differ from that toward club foot, for instance: that, untreated, it will grow worse with time. The longer the joint is out of place,

the greater will become the incongruity of the joint elements. He felt very strongly that the orthopedists should to a certain extent act as propagandists in this matter and not let these cases run on until they are four or five years old on the proposition that they will then be better able to withstand manipulation at that time, as was taught some fifteen or twenty years ago.

Dr. Sayre's interesting account of Schede's case illustrates the theme of the present paper admirably. Correction of the anterior distortion should have been undertaken, instead of allowing the head to slip forward into "anterior transposition." The latter is really an antero-lateral redislocation, and should be so regarded. Despite the functional improvement which accompanies such "transposition," the head is not in the acetabulum, and would therefore be classed as a failure. He felt it to be a primary job to put the head into the acetabulum and keep it there. All the redislocations occur early, that is, within two or three months after the removal of plaster. These may be called "anterior transpositions," but they are in reality redislocations, and always harbor the possibility of developing into dorsal dislocations of the complete type.

DYSCHONDROPLASIA

MULTIPLE CARTILAGINOUS EXOSTOSIS, WITH REPORTS OF TWO CASES*

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IN 1915 Ehrenfried[1] studied and reported upon multiple cartilaginous exostosis. Later on (1917)[2] in a rather extensive article, he reviewed the American literature on the subject and added twelve cases of his own. More recently, Percy Stocks[3] covered the entire subject in an excellent monograph. The previous literature was gone over very carefully, 765 cases collected and reported and all the studies brought up to date.

FIG. 1.   FIG. 2.   FIG. 3.

FIG. 1. Photograph of Case 1 to show general appearance Note the large left lower extremity.
FIG. 2 Lateral view of Case 1 to demonstrate the abnormality of the hands
FIG. 3. Lateral view to bring out the abnormality of the legs

We review briefly what is known of this disease.

Nomenclature. The disease is designated by a number of names. The most common are: multiple cartilaginous

*Submitted for publication September 7, 1928.

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exostosis, hereditary deforming chondrodys-
plasia, hereditary multiple exosotsis, multi-
ple cancellous exostoses, ossified diathesis

2. Without associated exostoses. (a) Single;
(b) Multiple.

Group III.   Isolated Exostoses or Osteo-

FIG. 4. Roentgenogram of right wrist. The lower end
of the radius is distorted, increased in width; the
contour is irregular and the epiphysis is replaced by
bone, the density of which is less than normal.
There is no distinct regular epiphyseal line. Ulna
shows the same characteristic features as the radius.
The shafts of both bones are short and thickened.

and rachiticform enchondrosis. In France
it is also called *familier* or *héréditaire*. In
America, Ehrenfried's name, hereditary
deforming chondrodysplasia, has been gen-
erally adopted.

Stocks' classification of cases of exostoses
or enchondromata is as follows:

Group I.   Diaphysial Aclasis (Multiple
Exostoses), uncomplicated by Enchondromata.
(a) Cases with definite hereditary history, includ-
ing some exhibiting single growths. (b) Cases in
which heredity is not evident, but exhibiting
multiple exostoses or typical deformities.

Group II.   Enchondromata (single or multi-
ple). 1. Associated with exostoses in same
individual or family. (a) With hereditary
history of one or other abnormality. (b)
Heredity not evident. (1) Single; (2) Multiple.

FIG 5. Roentgenogram of left humerus. The ossification
of head and tuberosities and shaft is abnormal.
The head is expanded and the bone is less dense
than normal. The contour is irregular, giving a club
shaped appearance. The upper third of the shaft of
the humerus shows the medulla increased in width
irregularly and replaced by bone, the density of
which is less than normal. Irregular exostoses are
noted along the internal and external surfaces. The
shaft is short.

mata of Developmental type, but without
evident heredity.

Group IV.   Exostoses, Hyperostoses or
Osteomata, affecting only the Cranial Bones.
(a) With relatives similarly affected. (b) With-
out suggestion of heredity.

Group V.   Subungual Exostoses.

Group VI.   Exostoses of the Heel (including
some pseudo-exostoses due to calcification of
bursa).

Group VII.   Other pseudo-exostoses (Rider's
bone, etc.).

Group VIII. Cases of "Exostoses" (undefined). (Records 3000 cases.)

Etiology. Stocks shows that the disease

epiphyseal cartilage during the period of skeletal growth which is retarded. The process of cartilage cell proliferation becomes dis-
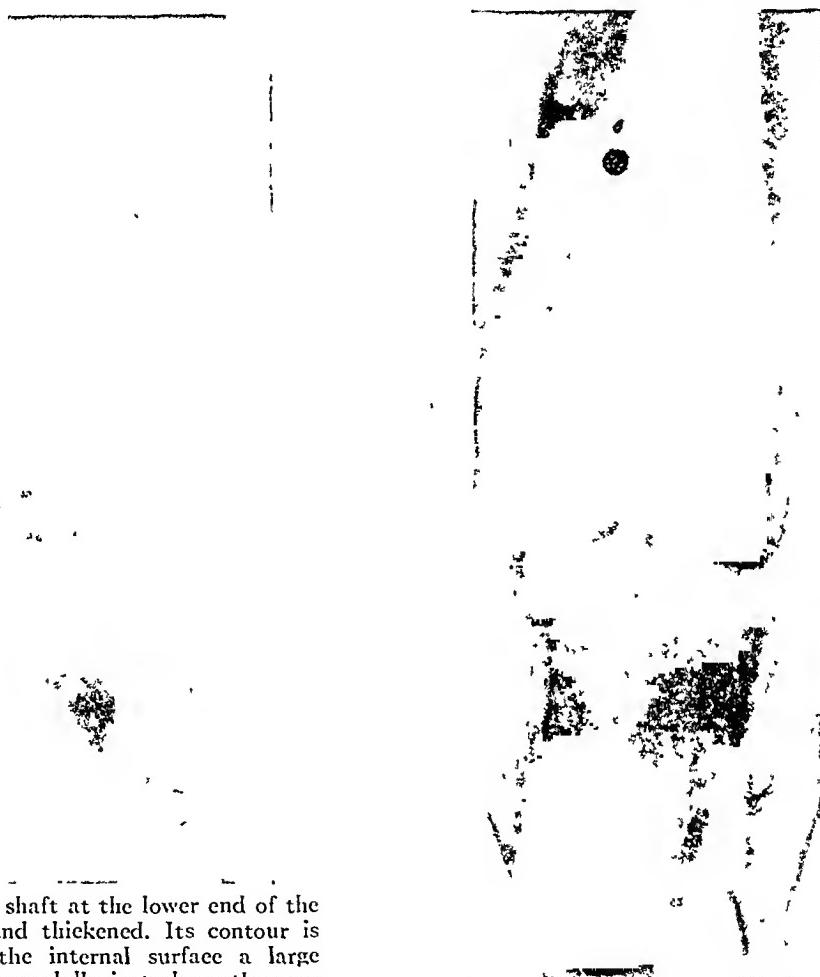
FIG. 6. Right knee. The shaft at the lower end of the femur is broadened and thickened. Its contour is irregular and along the internal surface a large exostosis is noted. The medulla just above the condyles is replaced by dense bone, the density of which is less than normal. The epiphyseal line is irregular. The general shape is that of a club and resembles a healed bone cyst. The upper end of the shaft of the tibia shows the same characteristic lesions as described for the femur. The upper end of the fibula, is broadened and thickened almost twice the size of a normal fibula irregular in contour and a large and irregular osteoid formation is noted on the posterior surface, resembling an osteochondroma. Ankylosis of the tibio-fibular articulation. (Distinct synostosis.)

FIG. 7. Left knee joint. Bony spicules at the femur and tibia. Firm union between tibia and fibula.

is of hereditary origin, about 64 per cent of cases being known to have at least one relative affected.

Pathology. According to Jones and Lovett:[4]

The disease consists of a disturbance of the process of proliferation and ossification of the

orderly and irregular, the growth of the cartilage is excessive, and the zone of proliferation and the end of the diaphysis are filled with masses of cartilage cells in irregular groupings, with some intermingling of marrow, and here and there imperfect efforts at calcification. Microscopically the resemblance to chondroma is striking, and this extends for some distance up the shaft, the end of which is ballooned out with the thin, irregular cortex being greatly rarified, so that in the x-ray it has sometimes the appearance of a bone cyst. This cartilaginous enlargement casts no shadow, and the little ossification present appears as fine strands running across the cystic space. The epiphysis is small or mis-

shapen, the intermediary cartilage small and irregular, and sometimes prematurely ossified. Scattered in the thickened periosteum in the

of the long bones, accompanied by outgrowths here of cancellous bone, is therefore the most characteristic feature of the disorder.

Fig. 8. Right ankle. The lower ends of the tibia and fibula are broadened and thickened and their contours are irregular. Varying density of the bone structures is noted. Ankylosis of the tibio-fibular articulation. Spur on inferior surface of os calcis.

Fig. 9. Case II. Right forearm, antero-posterior view, showing the marked deformity of the ulna.

shaft are found clumps of uncalcified cartilage cells which may later develop into multiple cartilaginous exostoses or chondromata.

Stocks writes:

Generally speaking, however, the disorder affects those regions where bone laid down within cartilage has to be surrounded and modelled by a sheath of bone formed beneath the periosteum (as at the growing ends of shafts of long bones), and the encasing process being defective, areas of bone formed in the core are left exposed on the surface without the controlling influence of the periosteal sheath.

Irregular development at the growing ends

Radiographic examinations carried out by Honeij, Ehrenfried and many other observers, show that these changes result in distortions of the epiphyses themselves (as, for example, in the fibula and acromion process of the scapula), in general thickening and enlargement of the ends of the shafts (commonly seen about the knee joints), and exostoses arising from uncovered areas or "islands" of endochondral bone. The latter usually occur near the ends of the shaft, but owing to the manner in which lengthening of the bone takes place, pieces of bone of endochondral origin may become detached from the growth disc in the early stages of growth, and are sometimes left near the middle of the shaft, from which exostoses may later develop. These mid-shaft exostoses, though relatively infrequent, are often the largest in size.

Main Symptoms. 1. Shortness of stature. 2. Short upper limbs. 3. Forearm

deformity. The radius is less affected than the ulna, hence it is longer than the ulna. The radius is therefore dislocated at its

FIG. 10. Case II. Right forearm, lateral view, showing displacement of the radius upward.

upper end and protrudes under the skin in the region of the external condyle which is often mistaken for a congenital dislocation of the radius. 4. Scoliosis. 5. Genu valgus. 6. According to Stoeks, "Assymmetry of limbs. The side of the body which presents most exostoses is not necessarily most retarded in growth; the reverse is often the case . . . 7. Talipes valgus, due to relative shortening of the fibula, is fairly common, and the tibia and fibula are not infrequently curved."

Complications. 1. Interference with joint functions. 2. Pressure on nerves, blood vessels or other organs. 3. Local inflammation and ulceration of the skin covering exostoses naturally occurs. 4. Exostosis bursata or secondary bursae covering exostoses.

Prognosis. According to Jones and Lovett: "The prognosis so far as life is concerned is good. When adult life has been reached without serious functional

FIG. 11. Case II. Left knee joint, showing marked bony exostosis on the femur, tibia and fibula. The motion, however, in this joint is free.

disturbance, the individual will probably go thru life with imperfect joints which will become less durable as he grows older, with the possibility of trouble from nerve pressure in certain locations."

Treatment. The same authorities say: "There is no known treatment beside the removal of obstructing exostoses, and the correction of bony deformity after skeletal growth has been reached."

CASE REPORTS

Case 1. John F., male, aged twenty-four, single. Came to see us at Fordham Hospital, April 1, 1928, for recent injury of the left knee which incapacitated him from working. Merely observing the patient was enough to enable us to recognize that we were dealing with a case of general bone disease. We therefore went into the history and physical examination very carefully.

Family History. Father of patient died of apoplexy; mother of operation for gall stones;

one brother and three sisters alive and well. We asked him and his brother about the family history and suggested that they inquire in the family as to whether any relatives were similarly affected. Although they both said that there was no one, since most of the relatives are in Europe, we felt that this answer did not exclude the possibility of heredity here.

Previous History. Patient was the fifth child in the family; not known whether he was a nursing or a bottle baby; walked at a late age; managed to get through public school education and one and one-half years of high school; learned sign painting at which trade he is at present employed; apparently had no difficulty in following his occupation.

Present Illness. At the age of four while still in Europe he was extremely emaciated. The first thing he remembered was an accident to his legs at the age of four and from that time on he was unable to walk as a normal child; he attended an orthopedic hospital from the age of four to ten. The mode of treatment, to judge by his reports, was unscientific; no roentgenograms were taken and no definite diagnosis reached. The records of that hospital were not available.

After the age of ten, he could walk like other children, play ball, etc., but could not run. He always noticed that his joints did not have a normal appearance but was able to learn the trade of sign painting and to follow it.

Physical Examination. The patient looked in fair health, although not robust. He was of short stature, only 4 ft., 10½ in.; weight 100 lbs; head was somewhat large but showed no abnormality. The joints at the epiphyseal lines of both wrists, ankles and knees showed marked irregularity. Distinct irregular bony masses were palpable. They did not cover the entire circumference of the bone but seemed to be more on the radius and tibia. The impression might perhaps be described as the feeling which would result if small fragments of bone were strewn over a large smooth bone. None of the masses were tender.

Upper Extremities. Fingers were of abnormal length, the index, smaller than normal, reaching only to the distal interphalangeal joint of the middle finger. A few phalanges showed bony irregularities. Forearms did not show ulnar deviation; pronation and supination were markedly limited; motion of the shoulder joints, free.

Lower Extremities. Motion in the hips,

knees and ankles, was free. The great trochanter on the right side was very prominent. The knees were very large especially at the

Fig. 12. Case ii. Left ankle joint, showing marked bony exostosis of the tibia which forced the patient to consult us.

lower third of the femur; knock knee on the left side. Both feet were markedly everted. No spasm was present. There was slight hallux valgus. Scoliosis was present, right dorsal and left lumbar. The sexual organs and covering of hair over the body was normal.

Roentgenograms were taken of almost all the bones. The skull showed no abnormality while the long bones showed the typical changes of dyschondroplasia. Figures 1 to 8 will help in the proper visualization of the case. The only bone which was of different structure was the right femur (Fig. 6).

The bones affected were as follows: Right side, tibia (both ends), fibula (both ends), os calcis, femur (lower end), radius and ulna (lower end). Left side, femur (lower end), tibia and fibula (both ends), humerus (upper end), radius and ulna (lower end).

Laboratory Findings. Wassermann, negative; urine, no albumen, no sugar.

Treatment. As the patient had no limitation of motion caused by the bony masses, no treatments were given.

Case II. Paula S., aged fifteen. Came to Fordham Sept. 20, 1928, for deformity of left leg.

Family History. No consanguinity. Had one uncle, brother of mother, who had exactly the same trouble with left leg as she had; also an older brother with similar trouble. Mother, uncle and brother had also the same trouble as patient, on the ring finger of right hand. I could not get their consent to make careful examination of their deformities.

Previous History. Patient was the second child in the family; birth normal; bottle fed; walked at one year of age; had a regular school education.

Present Illness. Immediately after birth it was noticed that there was some deformity of the right elbow joint. She could never use the right hand normally. Consulted several orthopedic surgeons who advised operation but patient refused. She came to us mainly on account of the leg deformity. She became sensitive as the deformity was prominent on the anterior aspect of the leg although it gave her no pain whatever. The only disability present was in the right elbow joint.

Physical Examination. Patient appeared in good health. Right forearm was in pronated position and elbow slightly flexed. Could not supinate; could not flex the elbow more than an angle of 110°; extension permitted to an angle of 160°. Ring finger was flexed at the proximal interphalangeal joint at an angle of 150°. Swelling was present. Finger could not be extended. Left wrist was also enlarged but motion was free. Lower extremities showed marked enlargement of the two tuberosities of both tibiae. Left tibia showed enlargement at the middle of the crest. Patient had double flat feet.

Roentgen-ray showed involvement of both tibiae (upper and lower ends), left tibia (middle of crest), left femur, both radii and ulnae. Spine and hips were free. (See Figs. 9, 10, 11, 12.)

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SPINAL ANESTHESIA*

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I HAVE selected spinal anesthesia in the hope that it will interest the majority, for though its actual use may not arouse the enthusiasm of the internist or the specialist of the organs of the head, a complication occasionally arises from its improper administration which has been known to inspire the intense interest of neurologist, ophthalmologist and pathologist as well as clinician and surgeon.

On April 28, 1926 we began, at the Post-Graduate Hospital, the use of spinal anesthesia induced by injecting neocaine in the subarachnoid space, and it has since been used by the surgeons of that institution in over 600 cases with comparative success and no outstanding ill effects.

During the early spring of that year I was impressed by the number of pulmonary complications which developed following ether and other forms of general anesthesia. While I was giving considerable thought to the subject I witnessed a demonstration of the form of anesthesia by one of the junior surgeons of Gouverneur Hospital. The technique of its administration was so simple and the anesthesia obtained so perfect that I decided to try it. After using it several times at Gouverneur Hospital I began its use at the Post-Graduate. Fortunately at that time the house surgeon at the Post-Graduate had had considerable experience in giving intraspinal medications, a short time before coming to us, on the children's service of the Massachusetts General Hospital. I feel indebted to him for the perfection of the technique which enabled us to recognize its possibilities and prevented our discarding it because of its failures and ill effects, as have many of the larger clinics of this country.

Spinal anesthesia was first used in the experiments of Dr. J. Leonard Corning, published in the *New York Medical Journal* of October 31, 1885. He experimented on a dog, injecting a 2 per cent cocaine solution in the lower dorsal region and obtained paralysis of sensation and motion in about five minutes followed by complete recovery without noticeable ill effects.

Corning was not a surgeon so he did not have the opportunity of applying this method of anesthesia further; besides, it did not meet with the approval of his American colleagues. It was abandoned until during the year of 1891 when Quincke became interested in the subject and finally aroused the enthusiasm of August Bier of Bonn. Bier first tried the method upon himself, having one of his assistants administer it. He thought, after his personal experience with it, that it would be of value in surgery and began its use in his clinic. The anesthesia was satisfactory and it was soon in general use on the Continent, in England and in the United States.

The enthusiasm resulting from its general use, like all other radical innovations, was soon followed by a reaction and it was practically abandoned as a routine procedure. Fortunately it was persisted in by a few who sought to improve the results already obtained by employing less toxic drugs (for up to this time only cocaine had been used), and also by improving the technique of its administration and the general handling of the patient. Since that time a number of drugs have been injected into the subarachnoid space to produce anesthesia.

Our experience in this series of cases has been limited to one drug, namely neocaine, prepared and dispensed in ampules.

ADMINISTRATION

The instruments necessary for its use are one 10 c.c. glass syringe, one ordinary

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* Read before Hospital Graduates' Club, New York, April 26, 1928.

hypodermic syringe with small needle, two intra-spinal needles about three inches long, No. 18 to 20 bore, with stilettes which accurately fit the needles, one ampule of sterile novocaine and ampules of neocaine in varying sized doses. The needles should be made of rust-proof metal and should have a short bevel point with contained stilette to fit the point accurately. They should be very sharp and should not be used after becoming dull.

The syringe and needles should be boiled in distilled water in a small sterilizer which should be scrupulously cleaned and free from any small particles of rust or foreign material. Special stress should be laid upon this point.

The ampules containing the neocaine crystals are prepared in doses of 0.10 gm. and 0.12 gm. and used according to the weight of the patient.

The dose ordinarily used is .01 gm. to each 14 lbs. of body weight. For an adult patient weighing 140 pounds or under we use the .10 gm. dose; if the patient is very emaciated or under weight the dose is graduated accordingly. The ampules are sterilized by immersing them in alcohol before opening.

The patient, if in good condition, sits across the center of the operating table with feet resting on a stool and leans forward with the elbows on the thighs, arching the spine backwards. The back is painted with 3½ per cent tincture of iodine.

The interspace into which the needle is introduced is selected by finding the 4th lumbar spine which is on a line drawn from one iliac crest to the other. The spines are then counted upwards until the interspace is found, which experience has taught is the proper level to inject in order to produce anesthesia below that point. If the lower back is fleshy so that the lumbar spines cannot be recognized with ease the 1st thoracic spine is located because of its prominence and the spines are then counted downwards. Another means of locating a given interspace is to find the 7th dorsal spine, which is the next spine above a line connecting the lower angles of the scapulae when the patient is in erect sitting posture.

After the desired interspace is located an identation is made over the area with the thumb nail. A wheal is made in the skin by introducing a little novocaine with a small sharp needle, then about 1 c.c. of the same solution is injected as the needle is introduced down to the spinal ligaments. This is a very necessary part of the procedure if the drug is to be properly given. It renders painless the area through which the spinal needle is to be introduced, therefore the patient is relaxed with the spine arched backwards, and there is no spasm of the muscles to lessen the distance between the spines. This is very essential especially when a high injection, that is, in the lower dorsal region, is given. It is easy to introduce the needle in the lumbar section of the spine but quite a different matter to introduce it in the dorsal region, which requires experience and at times much patience. Then another wheal is made over the upper border of the gluteus maximus muscle of the buttock, and 1 c.c. of adrenalin chloride, 1:1000 solution, or .05 gm. of ephedrine, is given intramuscularly. The reason for giving this will be discussed later.

The intraspinal needle is then gently and slowly introduced into the subarachnoid space. With a little experience one soon recognizes the resistance offered first by the dura then by the arachnoid. The stilette is withdrawn and the first few drops of spinal fluid are discarded; this is done to be sure the needle is washed from within outwards. The spinal fluid is then collected in the ampule containing the neocaine which is readily soluble. The contents are drawn into the syringe and the syringe connected to the needle which has been introduced. A small quantity of fluid is drawn into the syringe to be sure the point of the needle has not moved. The contents are then injected slowly until a very small quantity remains in the

syringe. The piston is again withdrawn just enough to be certain that undue pressure has not been used in the injection thereby moving the needle, then the injection is completed. The needle is withdrawn and the patient is allowed to lie on the table. A web belt is placed across his lower thighs and one arm gently strapped to the side of the table. The other arm is left free and placed on an extension on the side of table so that the blood pressure can be watched during the operation. The table should be comfortable, preferably with a soft pad, because if the operation is a long one patients become restless from discomfort alone. The patient's face is wrapped with cold wet towels and cracked ice or cold water given in small quantities by the anesthetist. Every reasonable request of the patient should be granted as quickly as possible. There is nothing so annoying to the patient or surgeon as to have a repeated request for a drink or some simple comfort not only ignored but followed by a low grade of vocal anesthesia. No form of anesthesia demands a more tactful anesthetist than this one. He should be thoroughly experienced in administering gas-oxygen, ethylene or any other anesthetic which may be required in an emergency. No doubt one reason why spinal anesthesia has been greatly discredited is because insufficient stress has been laid upon the skill and ability required of the anesthetist. I have frequently been successful in convincing the patient that a complete anesthetic was being used by having the anesthetist administer an occasional drop of ether.

SELECTION OF PATIENTS

This is of utmost importance, especially until one has had considerable experience with spinal anesthesia. Aside from certain pathological conditions there are many other factors which render its use undesirable in certain cases. We make it a rule never to insist upon patients having it. If we are reasonably sure that it must be used this is explained to the patient and it

is the exception to have one refuse it. It is generally considered that any mental or nervous condition contraindicates its use. I have had one fatal experience with a patient who had what appeared to be a mild mental disease.

A man thirty-eight years of age, was referred to me for operation for inguinal hernia with the request that spinal anesthesia be used on account of his susceptibility to colds. The usual physical examination was made but I did not notice until later that a careful history had not been taken. Less than .10 gm. of neocaine was used as the patient was undeveloped and weighed only 135 lbs. The anesthesia and operation were completed very satisfactorily and the patient reacted normally.

Thirty-six hours after the operation the patient became violently insane and had to be restrained. When I went to see him several patients in the ward volunteered the information that shortly after admission the evening previous to the operation he had acted very peculiarly and had amused them by relating preposterous tales. We also obtained an accurate history which revealed that several members of his family were highly nervous and that one brother was in an insane asylum. He died twelve hours later with a temperature of 105°F.

Lumbar puncture was made just before death which showed normal spinal fluid and was sterile after forty-eight hours with the usual culture media.

An autopsy was performed, removing all organs including the brain and spinal cord but no signs of any pathology whatsoever were found.

It may be that the result would have been the same with any form of anesthesia but it is difficult to avoid associating the death in this case with spinal anesthesia.

Patients with low blood pressure or those who cannot stand a sudden drop in blood pressure are bad risks. This applies to advanced cardiorenal disease, tuberculosis or any chronic debilitating condition. We have not used it in very young

children, although it has been used by many with satisfactory results in infants. Waugh reports a case in which he reseceted 6 inches of the small intestine in a baby eighteen hours old. The baby recovered and was discharged two weeks later. Neither have we used it in very old individuals, that is, over seventy-five years of age. I have noticed that older people do not seem to stand it well.

One should be cautious in employing it in operations for large abdominal tumors, as the sudden release of intra-abdominal pressure might add to the already lowered blood pressure produced by the injection.

PHYSIOLOGY

The effects are those produced by the action of the drug upon the sensory and motor nerve roots within the subarachnoid space; upon the cord itself; and from its effects after being absorbed into the blood stream.

The blood pressure is lowered by the action of the drug upon the vasomotors which leave the anterior roots by way of the rami communicantes causing dilatation of the splanchnic veins.

This is by far the most serious complication of intraspinal anesthesia. It occurs when the injection is given too high, also when a solution is used which has lower specific gravity than spinal fluid.

The specific gravity of spinal fluid is slightly increased by the addition of the crystals of neocaine, hence this danger is minimized by this method.

The blood pressure is also lowered by using too much spinal fluid as a diluent or by using undue pressure in making the injection. We have found that the blood pressure is not lowered so much if the shoulders and head are slightly elevated, but if the blood pressure becomes dangerously low the head is lowered, as by this time the action of the drug is more or less fixed. On the other hand if a small dose of neocaine is used by means of a low injection a higher level of anesthesia is secured by lowering the head immediately afterwards.

A higher level of anesthesia is also secured by using undue pressure in giving the injection. This practice is a dangerous one and we do not recommend it.

In addition to the action of the drug upon the vasomotors the blood pressure is also lowered by paralysis of the abdominal muscles. I know of no anesthetic which gives such complete abdominal relaxation as this one; therefore one can readily see the distinct advantages in operating upon cases of generalized peritonitis.

An illustration of its value has been seen in operating upon 2 patients having perforated duodenal ulcers. Both cases had had recent nasopharyngeal infections.

In addition to the "abdominal silence," a term which aptly describes the action upon the abdominal muscles, the effects upon the viscera are most gratifying. The stomach and intestines are contracted and peristalsis is increased. This is due to paralysis of the sympathetic nerve supply which normally inhibits intestinal peristalsis. The gaseous distention commonly found associated with ether anesthesia is not present and the intestines literally hide themselves in the abdominal cavity. I have seen this present to such a marked degree that great difficulty was encountered in palpating the duodenum for a suspected stone in the lower end of the common duct. The entire small intestine was contracted to a mere cord the size of one's little finger.

Occasionally a patient having spinal anesthesia will complain of embarrassed respiration, due to paralysis of the muscle of the chest wall. This occurs when the anesthesia has traveled above the level of the diaphragm. I have also noticed it when undue traction is made upon the liver in order to expose and remove a difficult gall bladder. The embarrassment quickly disappears with the administration of light gas-oxygen anesthesia.

The effect upon the circulation is directly dependent upon the height reached by the drug in the subarachnoid space. When the upper dorsal segments are paralyzed there is sure to be a marked fall

in blood pressure and slowing of the heart action. I know of no other condition in which we find a fall in blood pressure associated with slowing of the heart beats. This is again caused by paralysis of the sympathetic accelerators of the heart, leaving the vagus unopposed. It is also avoided if the dangerous height is not reached.

Pallor is almost always present and is an indication that the desired anesthetic effect has been obtained. It is thought to be due to the effect of the drug upon the thoracic nerve segments and perhaps partly due to absorption of the drug into the blood stream.

From the same cause occasionally faintness, nausea and vomiting are present. These symptoms are avoided by the administration of a small quantity of oxygen during the operation.

I have never encountered these symptoms to an alarming degree because I think they have been avoided by careful selection of cases and by prophylactic doses of adrenaline or ephedrine. One or the other of these drugs is always administered intramuscularly at the time of the injection.

De Eds has shown that ephedrine does not contract blood vessels by action on the sympathetic nerves as does adrenaline, but by direct stimulation of the muscles of the vessel wall.

Adrenaline causes first a contraction and later a dilatation of the blood vessels because the sympathetic carries both constrictor and dilator fibers and the drug stimulates first the one and some time later the other. Ephedrine stimulates muscle alone and so has no secondary dilatory effect. While the two drugs are very similar in chemical structure they are not identical and act by different methods. It would appear that ephedrine should have the preference of the two in combating low blood pressure. Its effects last longer and its action is about as quick. Both of these drugs act well if administered before the fall in blood pressure but it

should be remembered that their action is slow and not as reliable if given intramuscularly in the presence of already lowered blood pressure. When they have been used at the time of the injection we have found that occasionally the blood pressure is elevated rather than lowered.

If the fall in blood pressure becomes alarming either drug may be administered in small doses intravenously, adrenaline in 3 to 5 minim doses and ephedrine is reported to have been given in .05 gm. doses. I have never had to administer either one intravenously. However alarming the sudden fall in blood pressure may be it is usually of short duration and quickly reestablishes itself as the effects of the drug wear off.

We have not had a case of respiratory failure accompanying spinal anesthesia. Should it occur artificial respiration should be given until its effects wear off.

It should be remembered that peristalsis is increased and since the spincter muscles are relaxed there may be evacuation of the bowels during the operation; therefore care should be exercised in using the Trendelenberg position for operations upon the vagina or pelvis lest the field of operation become soiled.

TYPES OF OPERATIONS

We have not attempted to use spinal anesthesia for any operations above the diaphragm although in many cases anesthesia has been obtained up to the level of the clavicles.

Although I have used it in operations upon the stomach and gall bladder with gratifying results no doubt its greatest field of usefulness is confined to surgery below the umbilicus.

It is ideal for hernia operations, especially in patients in whom satisfactory relaxation of the abdominal muscles cannot be obtained with ether.

For most operations upon the pelvis both in males and females it is *most* dependable. I recall the case of a woman who was admitted to the Post-Graduate

Hospital with a diagnosis of ruptured ectopic. By the time I saw her she was pulseless and could not be aroused. In the ward she was given a very small dose of spinal anesthesia in the 3rd lumbar interspace, then was taken to the operating room where an intravenous injection of saline was begun while preparations for the operation were being made. The bleeding tube was removed quickly through a low midline incision and the patient was returned to the ward where a transfusion was given as soon as a donor could be obtained. She made a good recovery.

For operations upon the prostate it is a most desirable form of anesthesia. Although it is not as much used on the genitourinary service at the Post-Graduate Hospital as caudal anesthesia, the ease with which it is administered, the short time required for its administration and the rapidity of its action make it most satisfactory.

For operations upon the kidneys, bladder and diseases of the rectum, especially of tubercular etiology, we prefer it to ether.

Other conditions in which we have found it especially useful are operations upon the lower limbs, as dislocated semilunar cartilages of the knee joint and amputations. In these conditions good results have been obtained by giving very small doses of neocaine in the 4th and 5th lumbar interspaces. During the past month I amputated the thigh of a woman who was suffering from an acute abdominal disease when suddenly the right leg became cold and gangrene appeared in the toes, rapidly extending to the knee. She was admitted with a temperature of 103° F., very feeble pulse and marked diminution of urine, which contains 4 plus albumin, acetone and many red blood cells. After a hypodermoclysis of glucose with saline the thigh was amputated by use of .08 gm. of neocaine given in the 5th lumbar space. There was no shock, very little loss of blood and the patient is making a good recovery. In this case ether or even gas-oxygen anesthesia was contraindicated on account of the nephritis and tendency to embolism which had already occurred in the external iliac, causing the gangrene.

While all cases presenting unusually high blood pressure are poor surgical risks we have found that they stand spinal anesthesia well providing there is no pronounced evidence of cardiac disease.

UNTOWARD EFFECTS

I can safely state that, during our two years' use of spinal anesthesia pulmonary complications have been markedly diminished. There has been no case of pneumonia developing immediately after the operation. I have had 1 case develop pneumonia on the fourth postoperative day. This was a man seventy-two years of age who was operated upon for a gangrenous perforated appendix. He had a temperature of 103.5° F. at the time of operation. This had gradually become normal when on the night of the fourth day he developed pleuropneumonia of the right lower lobe, preceded by a chill and temperature of 104.°F. He died twenty-four hours later.

Before we began the use of spinal anesthesia it was not unusual to have pulmonary conditions following hernia operations evidenced by temperature of 103°F. or higher with expectoration of thick yellow sputum and numerous râles throughout both chests. These symptoms have not occurred in patients who have had spinal anesthesia.

We are frequently asked whether we have paralysis as a complication. This has not been known to occur except to the 6th nerve. We have had 4 cases showing this peculiar complication.

When we first began its use I operated upon a healthy young Italian for bilateral inguinal hernia. He requested that spinal anesthesia be used because a friend of his had just had it used upon him. The anesthesia worked beautifully and he made a most satisfactory recovery. On the ninth day when I called to see him I noticed that he covered one eye when he looked at me. He explained that he was

seeing double. Upon examination of the eyes I found paralysis of the left external rectus muscle. An ophthalmologist was called in consultation and he confirmed my diagnosis and referred me to a neurologist. The neurologist admitted that he was unable to help us as he excluded lues and encephalitis. We began to study the literature and found that this complication had occurred in other cases and that it would disappear, but we could find no satisfactory explanation for its occurrence. I assured the patient that it was due to the anesthetic and would soon disappear. It did after persisting for three months.

A short time later I operated upon a man at the Knickerbocker Hospital for hemorrhoids. He had been operated upon twice before, with pneumonia following the last operation, therefore a small dose of spinal anesthesia was used. He suffered from severe headache after the operation and on the seventh day he too began to see double. He consulted several oculists who became greatly interested in his trouble as none of them had ever seen a similar case. I assured him that it would soon disappear, being a complication of the anesthesia. He remarked that even though this condition might be permanent it was mild as compared to the pneumonia which had occurred before; besides he enjoyed leaving the patch off his eye while he counted his money. The only explanation I have found for this condition is that the 6th nerve is more exposed as it passes across the pons. This is to me a very unsatisfactory explanation but I can offer no better.

Since we have improved our technique by using a special sterilizer with distilled water, etc. we have not had this annoying complication.

Headache has been the most frequent postoperative complication. Numerous causes have been suggested for this, among them being:

1. The use of too large a needle which leaves an opening in the dura and arachnoid big enough to permit the escape of spinal fluid.

2. Withdrawal of too much fluid at the time of the injection.

3. Sudden withdrawal of the needle, causing the arachnoid to be pulled into the opening made in the dura, preventing the normal movement between the two membranes.

We have found that by elevating the foot of the bed 18 inches for the first twenty-four hours following the operation headache is rare and is not severe if it occurs. It is relieved by assuming the recumbent position.

CAUSES OF FAILURE

Despite every effort to give a perfect injection it is a well known fact that now and then the anesthesia will be a complete failure. This is due almost invariably to faulty technique. When the drug has been injected properly into the subarachnoid space there will be anesthesia. It may be that the dose was too small for the individual case.

If the needle has a long beveled point it is sometimes introduced so that the opening in the point does not go all the way through the arachnoid. In this case the spinal fluid drops very slowly until the needle is introduced a little farther. If this is not done before the injection is made some of the drug will never enter the subarachnoid space. It is also possible to obtain spinal fluid in some cases from the subdural space, and since there is no communication between the subdural and subarachnoid spaces the anesthesia will not be satisfactory if the injection is given in this space.

One experienced in spinal anesthesia may be deceived by an apprehensive patient, who, aware of being touched, as is the case in this anesthesia, anticipating pain, imagines it is present. I have handled this by diverting the patient until confidence in the anesthetic has been established. I have annoyed patients exceedingly by tickling the soles of their feet, while at the same time they were not aware of an incision being made in the knee joint.

Should the anesthesia fail another injection should be given. This is usually successful.

TIME REQUIRED FOR AND DURATION OF ANESTHESIA

As a rule the anesthesia is complete by time the field of operation is prepared, although occasionally it requires five or ten minutes before an incision can be made. Anesthesia lasts from thirty minutes to an hour and a half, usually about forty-five minutes when the average size dose is given. No operation should be undertaken which may require a longer time without having gas-oxygen or ethylene at hand. The mental effect produced by the wearing off of the anesthesia before the operation is completed is not a favorable one nor soon forgotten.

During the past two years we have performed some of practically all customary operations below the umbilicus with spinal anesthesia when it has been indicated. Many of these were operations which would not have been undertaken with ether or any general anesthetic and I know of no bad results which could in any way have been attributed to the anesthesia except the 1 case of insanity mentioned before.

It is difficult to determine from our records just how many failures to secure proper anesthesia have been encountered because we have used gas-oxygen or light ether anesthesia to allay mental anxiety in many cases. We *have had* absolute failures but when one considers that this form of anesthesia is being used in a hospital which makes a practice of teaching doctors and nurses how to give ether, gas-oxygen and ethylene anesthesia routinely, where the opposition to any other form of anesthesia would naturally be very strong, our results have been short of startling. We have had no one particularly skilled in spinal anesthesia to assume the responsibility but on the contrary it was begun and encouraged by the younger men of the staff and the greater number of injections have been given by the house staff which changes every three months.

It has withstood the severe criticism encountered in the beginning and at present is being used more and more extensively by the older men of the staff who have watched its results with critical eyes.

We do not claim that it is an ideal form of anesthesia, nor do we think that it will ever be substituted for ether. We appreciate its advantages and are aware of its limitations. We believe that our enthusiasm is justified as we know of no other anesthetic which affords as complete muscular relaxation, minimum loss of blood, absence of postoperative shock and few organic complications as the one I have attempted to describe.

GOITER IN CHILDREN

A CONSIDERATION OF TREATMENT*

H. D. KITCHEN, M.D.

WINNIPEG, MANITOBA

ENLARGEMENT of the thyroid gland is very prevalent among the children in certain parts of the North American continent, in common with other parts of the world, so a discussion of this condition is always of interest. It is held by some observers that most of these enlargements, if untreated, disappear spontaneously before the age of twenty-five and so there is no need of becoming alarmed about the situation and worrying about treatment. While it may be true that the majority do disappear, it seems nevertheless imperative that these goiters in children should be prevented if possible and treated energetically when they do exist. Although there is no proof that a thyroid, because of having been enlarged in childhood, is more likely to become the site of exophthalmic goiter in later life, yet it is reasonable to assume that if a thyroid enlargement has existed for some time with consequent formation of nodules and perhaps areas of degeneration, it will probably never regress to normal and will always remain a potential danger.

What is the best treatment? Prophylactic administration of iodine to all children of school age is undoubtedly the most satisfactory solution to the problem, but unfortunately, in some goitrous districts this has not yet been officially undertaken, although the grocers of most communities are forcing iodized salt upon the public and perhaps doing more harm than good. With the failure of preventive measures one must turn to a consideration of the treatment of the actual goiter. (I have purposely kept away from the term colloid, for we are not sure of the histological picture of these thyroids.) The work of Marine with iodine or hydriodic acid, of McCarrison with intestinal antiseptics in childhood goiter, and of Plummer with the use of thyroid gland in the goiter of young adults is too well known to warrant discussion here. Each of these competent observers has definite reasons for his therapeutic preference.

There are certain definite areas on this continent where goiter in children is very prevalent, areas in which it may be said to be endemic. Winnipeg is situated in one of these and the incidence of childhood goiter is quite high. In the past ten years there has been an apparent increase, which, superficially at least, seems to be coincident with the change in the city's water supply from artesian wells to fresh lake water piped in from Shoal Lake, nearly one hundred miles away. It seems reasonable to suppose however, that part at least of the increase is due to the interest in goiter and the care with which children are now examined in the public schools. Unfortunately there has not yet been a city wide survey of school children, so that the most accurate statement one can make is that there are a great number of goitrous children in the city and district.

In the Outdoor (free) Clinic conducted weekly at the Winnipeg General Hospital we have had the opportunity of seeing many of these cases and following some of them on treatment for a considerable time. While in the past three and a half years we have seen and examined nearly one thousand goitrous children, a large number of these have failed, in spite of follow up work done by our Social Service Department, to report at the Clinic more than two or three times, so that for purposes of study these are useless.

The main purpose of this communica-

TABLE 1

TREATMENT OF GOITER IN CHILDREN WITH DESICCATED THYROID SUBSTANCE. SYNOPSIS OF RESULTS IN 155 CASES

Age in Years							Sex		Size of Gland			Nodular	Vascular	B. M. R. Reading					Degree of Improvement			Total Improved
To 10	11	12	13	14	15	16	M	F.	Slight	Moderate	Marked			Below -10	-1 to 0	+1 to +10	+11 to +15	Above +15	None	Slight	Marked	
14	0	25	29	31	35	12	28	127	34	69	52	59	15	16	9	38	22	15	27 17.5 per cent	81 52.2 per cent	47 30.3 per cent	82.5 per cent

tion is to present some observations on the results obtained in the treatment of a group of patients followed for over three months.

In the beginning of our Clinic we used iodine in many cases (Lugol's, 1 minim daily or every alternate day) and, in others, we used desiccated thyroid gland, and were soon convinced that, taking cases as they came, thyroid gland therapy gave better results. Lately we have been using the latter treatment almost exclusively. Table 1 summarizes the group of 155 patients all of whom were given thyroid and observed occasionally for at least three months.

Ages. The majority of the cases are seen to be between the ages of twelve and fifteen, the adolescent age, during the period of child life when a greater demand than normal is being placed on the thyroid gland.

Sex. While the majority of our cases are in females this means nothing, as boys are, by nature, more indifferent about such unimportant matters as enlargement of the neck.

Size. The size of the goiters varied greatly and so they were classified as slight, moderate and marked: Slight, when the neck looked normal but when isthmus and 1 or more lobes were palpable; moderate, when to the eye of the layman the neck looked definitely full, and the gland was easily palpable; and marked, when the thyroid was so markedly enlarged that the outline of the lobes could be seen. This raises the question of how large a thyroid should be before being considered a goiter, and in our Clinic the answer is in the affirmative only when one or more lobes and isthmus are quite easily palpable. The mere existence of a band of isthmus which can be barely detected by palpation seems to be no reason for saying that a goiter exists.

Nodules. A large number of these goiters were by no means uniform in consistency, but on palpation one obtained the impression that certain areas were firmer than the surrounding gland. In the majority of cases these did not feel like real adenomas, accepting the term as meaning a freely moveable and encapsulated tumor, and their nature has always been an interesting speculation. It would appear probably that they are merely areas of degeneration, but until adequate microscopical studies are available, a possibility which is of necessity remote, their true nature must remain uncertain. They occurred most often in cases with a long history. In 4 of this series, 3 of them girls aged thirteen, there were definite, large (4 to 5 cm. diameter) freely movable tumors which were apparently true adenomas.

Vascularity. A few of the goiters were definitely vascular, with thrills and bruits over the thyroid arteries.

Nationality. This showed nothing of note, most of the cases being Canadian born, many of British, German, Hebrew, Polish or Ukrainian parentage.

Basal Metabolism. A basal metabolic rate was done in most of the cases, as a routine and not because hyperthyroidism

was suspected. (We have only seen, in our Clinic, 1 case of hyperthyroidism and that, in a boy aged thirteen, was definitely exophthalmic goiter. This case was more interesting because we had examined him one year previously, at which time the thyroid was slightly enlarged but symptomless.)

A perusal of the results of basal metabolic rates of 293 goitrous children shows the vast majority to be within normal limits, or slightly below normal. Although only one reading was done, each of these children was given a preliminary test to familiarize the child with the machine before the actual test was made. Some of the high readings were checked and found to be normal, the others were so normal clinically that repetition of the test was considered unnecessary.

In most cases there was no history of goiter in either parent. Many of the children were the only ones affected in a family of four or five, while in other instances almost all the children of the family were goitrous. These facts appear to constitute a strong argument against any one factor, such as a water supply, being responsible. It would seem reasonable to think that there may be various etiological factors such as septic foci in teeth or tonsils, poor hygienic surroundings, or, as McCarrison thinks, intestinal infections which might interfere with the utilization of the otherwise sufficient available iodine.

Improvement on Treatment. The results were fairly good. Figure 1 shows that 82.5 per cent of the total cases were definitely improved by treatment. In a group of 87 previous cases treated with iodine improvement was obtained in 67.8 per cent. In determining the amount of improvement stress was placed on what patient or mother thought; if they volunteered the information that the goiter was getting smaller such was usually the case. At each examination we measured the circumference of the neck with a tapeline (de Quervain) placed at the level of the upper border of the most prominent of the cer-

vical spines (usually the 7th) and around the largest circumference of the neck. In addition we estimated the size of the loebs
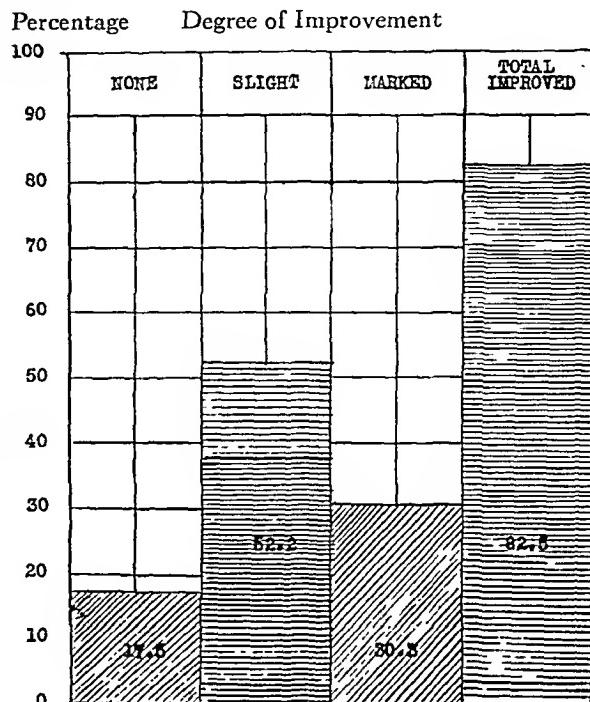
FIG. 1. Representing graphically the amount of improvement of goiter following thyroid therapy.

by palpation and recorded these measurements each time. This is probably the best method, as the factor of error is constant when all the examining is done by the same individual, while with the tapeline the circumference gradually increases with the growth of the child although the size of the thyroid may be diminishing.

Effect of Length of History on Result. It always appeared logical to assume that the longer a thyroid was enlarged the more refractory to treatment it would be. Table III shows an analysis of the results according to length of history, and it is evident that the improvement occurring in the recent cases (those with a history of under one year) was definitely greater than in the cases which had the goiter for a longer time. It is also true that the results as a whole were best in those cases treated the longest.

Our practice was to use 1 or 2 grains of desiccated thyroid gland daily, taken

TABLE II

IMPROVEMENT BY AGE GROUPS

Age in Years	Number of Cases	Sex		Size of Goiter					B. M. R. 1 Reading					Degree of Improvement		
		M.	F.	Slight	Moderate	Marked	Nodular	Vascular	Below −10	−10 to 0	+1 to +10	+11 to +15	Above +15	None	Slight	Marked
10 and under	14	3	11	8	4	2	3	1	1	6	3	..	2	1	9	4
11	9	1	8	3	4	2	2	1	1	5	1	..	1	2	3	4
12	25	7	18	8	−	10	8	5	1	2	5	10	1	−	13	5
13	29	9	20	6	11	12	13	3	4	7	8	3	5	5	16	8
14	31	4	27	5	18	9	11	..	6	13	7	2	1	4	16	11
15	35	2	33	3	20	11	13	3	3	14	10	4	1	6	16	13
16	12	2	10	1	5	6	9	2	..	2	4	3	1	2	8	2
Totals	155	28	127	34	69	52	59	15	16	49	38	22	15	27	81	47

either after breakfast or in divided doses, after breakfast and lunch, never after the evening meal. In some cases we kept up the thyroid continuously for over a year with no untoward effects. It is a widely recognized fact, of course, that the absorption of iodine and of desiccated thyroid from the intestine may be interfered with in these cases of adolescent goiter, and as in most of our cases we made no effort to push the dosage up to the point of producing hyperthyroidism, it is probable that in some of the failures no absorption of thyroid was occurring. In one or two of our failures the amount of thyroid was increased until one of the cases, a girl aged thirteen was taking 15 grains of desiccated thyroid gland daily without any signs of hyperthyroidism, the pulse remaining at 70 and the weight increasing.

CONCLUSIONS

1. From these results it appears that the consistent oral administration of safe doses of desiccated thyroid gland sub-stance (1 to 2 grains daily) results in the improvement of the majority of cases of childhood goiter.

2. It can be used over rather long periods of time. Frequent observation of the patient must be made and the occurrence of any signs of hyperthyroidism, e.g., headache, increased pulse rate, loss of weight, insomnia, nervousness, etc., should be carefully noted and the dosage immediately reduced.

TABLE III

RELATION BETWEEN LENGTH OF GOITER HISTORY AND AMOUNT OF IMPROVEMENT OBTAINED

Length of History	No. of Cases	Degree of Improvement			Total Improved (Per cent)
		None	Slight	Marked	
Recent cases (under 1 year)	70	8 / 11.5 per cent	37 / 52.8 per cent	25 / 35.7 per cent	88.5
Old cases (over 1 year)	85	19 / 22.4 per cent	44 / 51.8 per cent	22 / 25.8 per cent	77.6

IMMEDIATE PREOPERATIVE TREATMENT OF EXOPHTHALMIC GOITER*

J. Tate Mason, M.D.

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THE treatment which I wish to present was begun, first, on the extremely ill patients. As time went on we noticed that they responded so satisfactorily that it is now used as routine on all exophthalmic goiter cases.

We have, for some years, endeavored to classify exophthalmic goiter in a workable way. This was attempted so that the internist, surgeon, laryngologist, nurse and everyone concerned with the case might understand what was to be expected in each case.

The classification which we use is purely clinical and embraces four groups or stages. In the first stage are the patients who are seen very early, probably six or eight weeks in the disease, at a time when diagnosis is difficult because no specific criteria can be fixed as to when normal function of the gland ended and hyperthyroidism began. This stage is designated as the "early exophthalmic."

In the second stage are the patients who come for examination later, one or two months before crisis occurs. In them are found pronounced and progressive toxemia, loss of weight, rapid pulse and a high basal metabolic rate. This stage is designated as "acute ascending exophthalmic."

In the third stage are the patients who have reached the crisis. From the standpoint of toxemia, the gland is giving off its maximum amount for that particular case. Some of these patients even in this stage are not extremely ill; others are in a condition characterized by cardiac decompensation, vomiting, acidosis, prostration and delirium. This stage is designated as the "crisis."

In the fourth stage are the patients who have passed the crisis and have been ill for some years. In them are found marked exophthalmos and some bronzing of the skin. The metabolic rate is always above normal but never runs very high. Usually these patients carry on their work with difficulty, no matter how light it may be. Even compared with their former state of illness, their present condition is very bad. These we call the "late exophthalmic" or "educated gland" cases.

There are two classes of patients with exophthalmic goiter who require a great deal of care and observation. The first class includes young girls who develop the disease and become worse so rapidly that they may die in an explosion of hyperthyroidism, so violent that not all the classical symptoms have developed, i.e., the patient may have no exophthalmos, relatively little enlargement of the gland and occasionally little tremor, but has very marked prostration, weakness, vomiting, nervous symptoms and extremely poor pulse. Patients of this extreme type are usually light-haired blondes, inclined to be fleshy, with small wrists and tapering fingers. Even in the absence of complaint one would say at a glance that these individuals are not able to stand much physical strain.

The second class includes patients in the forties or beyond who develop the disease rather suddenly and who do not present appreciable enlargement of the thyroid gland. They may become ill so rapidly that one must assume either a very poor resistance to the disease on the part of the patient or that the toxemia is

extremely grave. Skin pigmentation, sometimes so marked as to suggest Addison's disease, is particularly common in this


FIG. 1.

group. The thyroid gland is small and on palpation is hard. In these cases the diagnosis is often missed. The microscopic picture, however, is typically that of exophthalmic goiter. In each case studied we have found very rapid weight loss, tremor, irritability, rapid heart action, increased metabolic rate and marked loss in strength but no exophthalmos.

In the three groups, i.e., those patients in crisis, the young girls and the patients in the fifth and sixth decades of life and with no appreciable enlargement of the thyroid gland, we see our very worst risks. Each patient has to be handled with extreme care after the diagnosis is made.

In looking over our series of postoperative difficulties and fatalities, we were impressed with the fact that these patients came from one of these groups.

In looking over our list of extremely stormy, immediate postoperative reactions, or those where fatality had occurred, we were again impressed with the fact that these patients had not gained weight but many of them had lost a few pounds just before operation. We came to the conclusion that if we are to prevent the occasional postoperative explosion which often wrecks the patient almost unto death, the preoperative treatment must be such that a gain in weight of at least 2 to 10 lbs. will

occur. This fact was particularly impressed upon us again when we studied a group of cases in which there had been even and
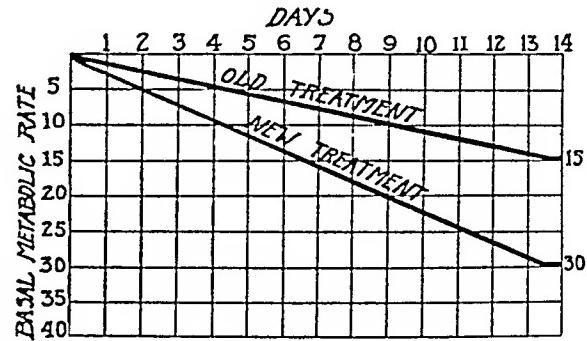
FIG. 2.

progressive convalescence. We found that most of these patients had gained some weight immediately prior to the operation.

As we are still in ignorance as to the cause of exophthalmic goiter we have decided on a course of treatment which combats some of the possible causes and includes management to increase the body weight by from 1 to 5 per cent.

No two extremely ill patients can be treated exactly alike. However, a general plan of treatment must be followed in all cases. As was stated before, we feel that this regime should be based on the possible cause of the disease as well as the symptoms. Recently Houda claims to have isolated a staphylococcus from the thyroid gland in over 300 cases. Infection as the cause of goiter has been suggested for years but definite proof of its relation is lacking.

The first, and most frequently mentioned, theory of the cause of exophthalmic goiter is that there is in the water an organic or inorganic chemical substance derived from the soil. Second, is the existence of a specific intestinal flora, the toxic products of which absorb the iodine of the food or in some other way deprive the thyroid gland of the iodine needed for the production of the 0.33 mg. of thyroxin metabolized by the ordinary individual each twenty-four hours. The third theory of the cause of exophthalmic goiter and the one we discredit more than any of the

others is the lack of iodine in the food. Bearing these theories of the etiology in mind, and with the desire to have as little postoperative explosion as possible the treatment was begun. It has been designated as a "ten procedure treatment."

TEN PROCEDURE TREATMENT

The ten procedures are as follows:

1. *Rest.* Complete rest in bed in the hospital in a quiet pleasant room, preferably alone, is demanded.

2. *Oxygen.* A plentiful supply of oxygen is furnished by free ventilation of the room and in extreme cases two hours each day in an oxygen tent is prescribed.

3. *Precordial Cold Application.* An ice bag is kept over the precordial region constantly.

4. *Distilled Water Only to Drink.* A large jar of cool distilled water (not cold) is kept by the bedside and the patient is requested to drink as much as possible. He is also asked to fill his glass completely each time and to drink all.

5. *High Caloric Diet.* He is encouraged to take a diet of five thousand calories' value daily. The diet is selected to contain large proportions of sea foods and asparagus, beets, carrots and mushrooms. These foods contain small amounts of iodine.

6. *Intestinal Antisepsis.* An intestinal antiseptic in the form of triple sulphocarbolate, grains 5, three times a day is administered.

7. *Colonic Irrigations.* A colonic irrigation of normal salt solution is given once a day. Iodized salt is used in making up the salt solution. Two quarts of the solution are allowed to run into the bowel under very slight pressure. When the patient expels it the procedure is repeated four or five times.

8. *"Night Cap."* At bed time a "night cap" consisting of 1 oz. of honey, a bowl of crackers (about 6), a pat of butter, and a glassful of milk with two heaping teaspoonfuls of lactose is given (700 calories). Ten grains of sulphonal are given at the same time to patients who sleep poorly.

9. *Oral Antiseptics.* The gums are swabbed twice a day with an antiseptic solution (2 per cent) of acriviolet. The
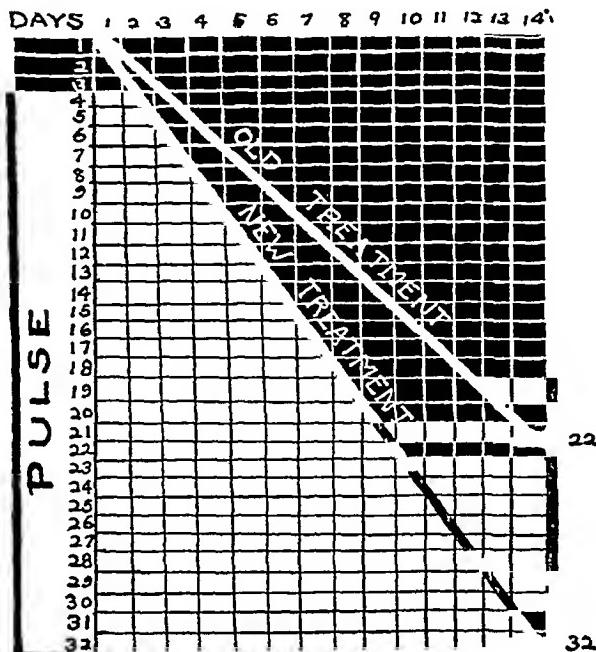
Fig. 3.

solution used is made up as follows:

Gentian violet (gram positive) 1 part
Acriflavine (neutral) (gram negative) 1 part.

Water to make 100 c.c. It is applied by means of cotton applicators.

10. *Iodine.* Lastly, iodine is given according to the degree of toxemia apparently present. The basal metabolic rate determination gives some information of the severity of the toxemia. The dose of Lugol's solution may be anywhere from 30 to 150 drops daily.

RESULTS OF TREATMENT

The past year there have been about 150 patients treated under this method. In comparison with the number treated as we treated them formerly with rest in bed and Lugol's solution and free diet we find that the average gain in these cases has been about 8 lbs. as compared to 2½ in the earlier group of cases (Fig. 1). The basal metabolic rate has fallen about 30 degrees

in the group treated with the ten-step procedure as compared to about 15 in the earlier (Fig. 2). The pulse rate has declined approximately 32 compared with a fall of 22 with the former method of treatment (Fig. 3). Under our present plan we have not had a single severe postoperative toxemia. Our observations would lead us to believe that while there are many parts of this treatment that do not mean any particular thing, and probably do the patient little good, still we do not know at the present time which parts to discard and which to keep. We are firmly impressed that some of the procedures in the ten are vitally important to these patients. In the minds of the resident physicians and nurses in charge, there is no comparison in the condition of the two groups of patients. In trying to size them up for comparison we picked patients with practically the same pulse rate, basal metabolic rate and of practically the same age. I present these facts for consideration because our experience has been so satisfactory with this method of treatment.

THE "ATYPICAL" IN THYROID WORK[*]

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IT is not the purpose of this paper to discuss all the conditions occurring in thyroid work to which the term "atypical" may be applied, but rather to draw attention to two problems which, in my opinion, are of sufficient importance to warrant consideration.

As stated by McClure,[1] nothing new has appeared in medical literature since the discovery of thyroxin by Kendall in 1914, in spite of the many hundreds of papers appearing on the subject. However, in a practical way, we may look back on the same period with a good deal of satisfaction as we visualize the progress made in the better understanding and management of this phase of our work.

The acquisition of such knowledge has made it possible to standardize our conception of diseases of the thyroid, in our own minds at least, and as a natural sequence, to adopt a standard treatment.

There are two forms of thyrotoxicosis, well described and differentiated by Plummer, which are so common in every day practice that we have come to regard them as typical. These are the adenomatous and the exophthalmic goiters, each requiring separate and distinct consideration and treatment.

Disregarding the endemic or colloid goiter, my conception of these two typical forms may be briefly summarized as follows:

1. Toxic adenoma presents itself with a history of indefinite onset, and shows symptoms such as nervousness, tremor, weakness and loss of weight. Adenomas are palpable in the gland, and the basal metabolic rate is usually raised. In the later stages of the disease the cardiac changes are accentuated.

This group does *not* stabilize under Lugol's solution; and in a palliative way is only influenced by rest. Thyroidectomy in one or more stages is the treatment of choice, and the prognosis depends upon the length and severity of the intoxication.

2. The other typical form is that of true Graves' disease, in which we elicit the history of a sudden onset and see one or more of the cardinal symptoms, such as weakness, tachycardia, tremor and exophthalmos with nervous symptoms predominating. In addition may be noted selective muscular weakness, inordinate appetite, loss of weight and changes in the gland itself, varying from a slight enlargement to a pulsating vascular tumor. A rise in the basal metabolic rate is to be expected and this will correspond very closely to the loss of weight.

This group stabilizes in every way under Lugol's solution, seldom requires a divided operation, shows a constant pathology in the gland after treatment, and from the standpoint of prognosis, follows out a very definite course which can be forecast even to guessing within a few pounds of the probable increase in weight.

The treatment and prognosis in these types are so clear-cut and the results usually so remarkable, especially in the exophthalmic variety, that we may justly feel that our therapy in these diseases approaches perfection more nearly than in any other of the major ailments to which man is heir.

When we realize the uniformity of our results in cases falling into these two groups, we experience a sense of keen disappointment when we come in contact with patients who do not react as expected, or in whom a thyroid intoxication was

overlooked. When this occurs, we are forced to conclude that these are "atypical" forms of thyroid disease.

I wish to call attention to two distinct types which I believe cause most of us considerable worry:

1. The case with symptoms of toxic adenoma without elevation of the basal metabolic rate.

2. The case simulating Graves' disease in which the metabolic rate is persistently normal. The latter might well be called "pseudo-exophthalmic goiter."

The first group includes those to whom operation has been denied from an over-estimation of the importance of the metabolic rate or from failure to detect pathology in the thyroid gland. This is usually due to improper or insufficient examination. It goes without saying that a patient presenting himself with a tremor and tachycardia should have a careful palpation of the gland plus a skiagraphic, as well as fluoroscopic, examination of the substernal region.

In palpation, such aids as the patient's swallowing or coughing and placing the patient in such a position that the neck is accentuated, should never be overlooked.

We have repeatedly seen adenomatous goiters produce symptoms of thyrotoxicosis without elevation of the basal metabolic rate. We have also seen a number of cases in whom a single hidden adenoma was the cause of attacks of dyspnea simulating asthma. In others, voice changes have been noted. In these the presence of a thyroid nodule was only detected by the recognition of a displaced larynx or trachea. A distinct adenoma, whether palpable or demonstrated by roentgen ray, should be treated by excision if any of the symptoms of thyroid intoxication or obstruction are present.

That any adenomas should either be removed or be under constant observation has been stressed by Pemberton, and yet I wish to emphasize the apparent ease with which pathology may be overlooked in a cursory examination of the thyroid, and the toxicity of the same

misinterpreted by the absence of a rise in the metabolic rate.

Our second group, which I have called "pseudo-exophthalmic goiter," includes those cases presenting symptoms of Graves' disease, nervousness and tachycardia predominating, who show no elevation of the basal metabolic rate, and in whom we have convinced ourselves no adenomas are present.

In addition to these major symptoms, the patients may have muscular weakness, heat intolerance, "flushing," gastrointestinal disturbances and possibly a slight rise in temperature. They are not worse in the morning, have not selective muscular weakness, nor do they show crises as in true Graves' disease. These patients pay particular attention to the symptoms which may have been suggested to them regarding their neck, i.e., feeling of constriction, choking and difficulty in swallowing which are rarely seen in true exophthalmic goiter. Most important is the fact that their symptoms start in early life and a careful history may discover a number of similar cases in the same family. This type was named the *forme fruste* by Charcot[2] who believed it represented an incomplete type of true Graves' disease. Hertzler's[3] opinion that Charcot was guided by symptoms present at a given time, and that he entirely ignored the onset, the physical substratum and the final course of the disease, is borne out by our own experience.

Such patients are so often the victims of over-enthusiastic specialism, that they present the greatest goiter problem of today. My own experience has been that many of these cases on whom I have operated have shown not the least improvement. Of those who apparaently have benefited by thyroidectomy at least 90 per cent show only changes which could be attributed to psychic causes and rest.

I have been able to follow enough cases operated upon at other clinics to assume that other surgeons are experiencing the same disappointing results.

Plummer[4] believes that cases of exoph-

thalmic goiter occur with no elevation of the basal metabolic rate. If this rate is persistently normal and the patient not under treatment, I believe this diagnosis a dangerous procedure. In the group under discussion operation is contraindicated and if undertaken will only react as a reflection against our diagnostic art and will place in disrepute a therapy, the success of which is without parallel in medical endeavor.

The more we study this problem, the more convinced we become that we are *not* dealing with disfunction of the thyroid gland, but with some condition simulating disease of that organ. Lahey[5] says, that when he does not get a cure following thyroidectomy, he has either not removed sufficient gland, or he has not dealt with a diseased goiter. Kocker's dictum: "No thyroid gland—no Graves' disease," if written today would probably read: "No thyroid, no elevation of the basal metabolic rate—no Graves' disease."

My reasons for this conclusion are as follows:

1. The reaction uniformly found in Graves' disease under Lugol's solution does not occur. What improvement there is may be accounted for by rest, and the thyroid gland shows no palpable change.

2. The pathological picture of the gland, if operation be undertaken, is entirely different from that met with in true Graves' disease following iodine administration. Broder's description of the exophthalmic gland as "swiss cheese" in appearance is entirely absent. The gland is "tough" in consistency and in a general way, in the gross, resembles a simple colloid.

3. Results following operation are never spectacular. As I said before, improvement may be put down to psychic causes plus rest.

4. As our experience grows and our poor operative results impress us more forcibly, we are finding causes outside of the thyroid gland which may produce these conflicting symptoms.

Only by careful observation through years where personal contact is possible, can one properly realize just how poor our surgical results are in this type of case. It may not be out of place to mention here how unreliable statistics may be. There are very few patients following any operation who will state that there has been no improvement when replying to a questionnaire. This is possibly due to a natural human dislike to admit the buying of a valueless article. We have found the observations of an astute family physician a better gauge of results than surgical statistics.

To the general practitioner and to those particularly interested in thyroid work, a study of the cause of what may be called pseudo-exophthalmic goiter is not only interesting, but very necessary. The fact that my explanation is theoretical cannot detract from the importance of the underlying causative agents, and the prognosis to the patient.

In studying the problem, I sent questionnaires to a number of our leading internists asking their experience in diseases causing nervousness and persistent tachycardia not due to thyroid disfunction. Barker, in answering, stresses psychoneurotic states, chronic infection and intoxications of various sorts. Meakins says that, so far as he knows, the only other condition which gives a tachycardia of normal rhythm is the so-called "soldier's heart," a parallel of which is found also in civil life. Most others agree with these opinions. The question may then be asked: Are there organisms which have a special selectivity for the nervous system and through it affect the cardiac centers? Experience seems to answer in the affirmative, for surely there can be no practitioner who has not observed the symptoms of nervousness, tachycardia, tremor and so forth, in patients with a history of influenza. It has been our observation that this infection leaves a much wider trail of these disabilities than does a rheumatic diathesis. To these two diseases we may add intes-

tinal intoxication, for we have seen several patients permanently cured of their symptoms by means of colonic irrigations when this diagnosis has been made. Such cases, however, are not numerous, for in the consideration of chronic infections as a cause of symptoms suggesting hyperthyroidism, one is at once struck by the infrequency with which these symptoms are cured, or even ameliorated, by a removal of such common foci as tonsils or teeth, even when definitely diseased.

While our observations seem to correlate many of these cases with a history of attenuated acute infections, a far greater number present themselves when the underlying factor (too frequently unrecognized) is an unstable condition of the nervous system.

This has been recognized by various authors. Crotti,[6] in a résumé of the experience of many neuropathic hospitals during the war relative to the "soldier's heart," concludes that "emotion, fear, fright, et cetera, are not to be regarded, at least in the majority of cases, as the primary causative factor, but only as a secondary one, the primary cause being an already latent unrecognized thyroid disturbance." He further adds that this minority group, as is apparent in every day life, has heredity as a possible predisposing factor. If his statement be true, then there are a great many victims of thyroid disease, in Canada, at least, who have been denied a much needed operation. My own contact with these post-war patients does not bear out the above contention; and my chief disagreement with Crotti is the number he classes as of thyrotoxic origin. I cannot believe that focal infection plays a very important rôle, but hold the view that most of this group belong to the aforementioned minority and should be classified as cases of neurosis with a hereditary basis.

My main reason for this view is that these patients do not improve after a thyroidectomy; nor can we take the same attitude of some others who attribute the cause of failure to the removal of insufficient gland tissue. It would seem more reasonable to believe that these patients have inherited a condition of hypertonus of the sympathetic system, as pointed out by Hesse and Eppinger, than to assume that this system is secondarily affected by an abnormal product of the thyroid gland. Indeed, we have observed that the more we investigate the family history in conjunction with the general practitioner, the more we are able to trace a familial tendency towards this so-called sympathetic hypertonus. A familiar example is the breeding of thoroughbred horses, and if such condition could be reproduced in man, we would have a perfect base for such cases as "soldier's hearts" or the "pseudoexophthalmic group of symptoms."

I have endeavored in a very brief way to outline two problems which seem to me "atypical" in thyroid work: The one in which I am afraid I may have missed the adenomatous goiter; the other in which I fear I have operated upon a normal thyroid.

Reading Plummer's masterly treatise in his Beaumont lecture makes us realize how meagre is our knowledge of this subject. My presumption in offering my own observations can only be warranted when I recall the remark of W. J. Mayo: "Posterity can be benefited only by the individual putting on record what he has actually observed."

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THE THYROID IN INFECTIONS AND TOXEMIAS

PATHOLOGICAL CHANGES IN THE HUMAN GLAND*

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THE occurrence of pathological lesions in the thyroid glands of presumably healthy people and patients dying without any symptoms referable to the thyroid is much more common than is generally conceded. We were greatly surprised to find that of a series of 41 thyroid glands removed at autopsy from patients dying from diseases other than those referable to the thyroid clinically, only 26.8 per cent could be classified as normal glands. A large portion of the 26.8 per cent contained some scar tissue and even small areas of focal hyperplasia which we believe were the results of injuries of a physiological or bacteriological nature, similar to the ones we are about to describe. The most common lesions were hyperplasia, desquamation and loss of colloid. This group comprised 36.5 per cent of the 41 cases; 17 per cent presented the picture seen in colloid goiters, except that the glands were only moderately enlarged. The predominating lesion in the remainder (19.5 per cent) was dense deposition of scar, which gave the thyroid a lobulated appearance.

In previous publications[1,2] we have called attention to the presence of a lesion consisting of hyperplasia, desquamation and loss of colloid in the thyroid gland of animals following severe infections or toxemias. Although not constant, such a lesions can be found in fully 80 to 85 per cent of animals dying from infections or toxemias. Organisms inhabiting the intestinal tract seem slightly more prone to produce these changes than the pyogenic group (Fig. 4). These same changes are almost constantly found in the thyroid glands of animals which have succumbed to intestinal obstruction, produced experimentally (Fig. 2).

Pathological changes in the thyroid as the result of acute infectious processes have been recorded by previous workers, but seem to have escaped generalized recognition in this country. Halsted[3] remarks that he noted, in 1888, that such changes occurred after experimentally produced infections, but we were unable to find his original article. A few years later, Sokolow[4] recorded pathological changes in the thyroid of human beings following infections. Roger and Garnier,[5] and McCarrison[6] have reported observations of a similar nature. In 1901, however, Kashiwamura,[7] in a study of the thyroid glands of patients dead from various infectious diseases attempted to disprove the findings of Sokolow and Roger and Garnier.

Concomitant with the production of hyperplasia, desquamation, etc. in the animal's thyroid, by serious infections or toxemias, we observed a pronounced and practically constant drop in the iodine content of the gland. Marine and Lenhart[8] have made careful studies of hyperplasia and iodine content of the thyroid gland of animals as well as humans and have noted that the iodine content varied inversely with the amount of hyperplasia. They remark that the three views regarding the cause of thyroid disturbances can be summarized as follows: (1) Active hyperplasia is a compensatory and secondary reaction to a disturbance of nutrition. (2) It is the result of a specific

infectious agent. (3) It is a primary thyroid disturbance. We feel that the possibility of demonstration of a specific

per gland. The weights varied from 20 to 30 gm. A few normal glands which we have analyzed have averaged 24 gm. in


FIG. 1. Normal thyroid of a dog. Note that there is slightly more hyperplasia than is seen in the human gland.

FIG. 2. Desquamation, loss of colloid and early hyperplasia seen in the thyroid of a dog dying from experimentally produced intestinal obstruction of nine days' duration.

infectious agent as the primary cause is remote, especially because such definite changes can be produced (Figs. 2 and 4) by any number of toxic and infectious agents. We concur in the opinion of McCarrison and others, that the production of simple goiters can be accounted for by a lack of iodine and by infectious and toxic agents. It is obvious that, of the latter group, physiological strains, such as puberty, pregnancy, etc., may be an important factor.

The iodine content of normal thyroid glands varies considerably, but is largely dependent upon the locality in which the people live. Baumann,[9] who first demonstrated iodine in the thyroid gland, reports extremely low figures. It must be remembered, however, that the glands upon which he conducted his experiments were obtained largely from a goiterous region. Wells, Marine and Lenhart and others report a higher figure of 12 to 16 mg. iodine

weight and have yielded an iodine content of 22 mg. per gland. It is quite probable that the higher figures of total iodine as obtained by us can be accounted for by the fact that the water and food in the vicinity of St. Louis have a relatively high iodine content. A large percentage of the supposedly normal glands removed from people who have succumbed to sudden death by accident will be found not normal. The type of lesion encountered in such instances is usually adenomatous in character, with small adenomas visible in the gross, but without any hyperplastic changes microscopically. The total weight of a gland of the adenomatous or colloid type as mentioned is practically always above normal.

It is agreed that the iodine content of hyperplastic and colloid glands depends for the most part upon the structure. Baumann, Wells, Marine and others have

noted that the total amount of iodine per gram of gland in hyperplastic goiters is usually less than half as much as normal,

thyroids as obtained at autopsy, and 18 goitrous glands (exophthalmic and adenomatous) as removed at operation. In view
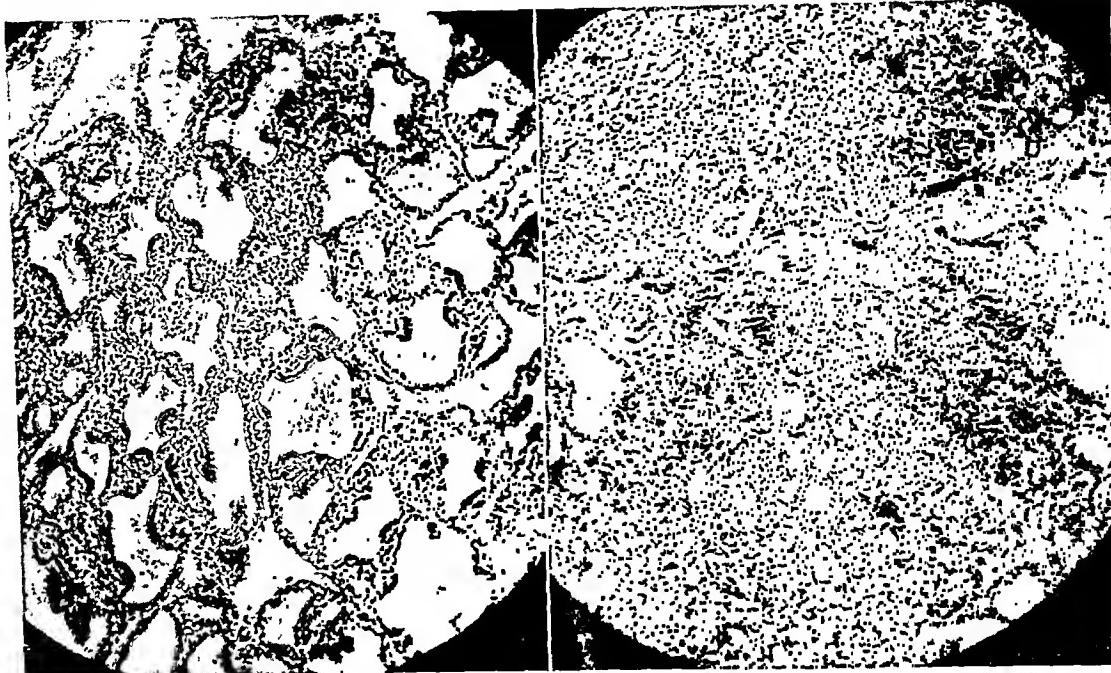

FIG. 3. Marked hyperplasia with piling of epithelium, scarcely to be differentiated from the picture in exophthalmic goiter found in humans not receiving iodine therapy. This was obtained from a dog with an infection of three weeks' duration produced by contamination of a neck wound with fecal matter and implantation of a foreign body to prevent healing. Hyperplasia of this extent occurs only in a small per cent of cases.

FIG. 4. Desquamation of acinous cells, loss of colloid and early hyperplasia produced in the thyroid of a dog which received two injections of "loop toxin" containing B. coli, proteus, Welchii, and hemolytic streptococcus. The amount of iodine contained in the gland was low: 0.112 mg. per kilo of body weight as compared to the normal amount of 0.304 mg. per kilo of body weight (see also Fig. 5).

but that the total amount is only very slightly below normal figures. In colloid and adenomatous goiters the total amount of iodine may be 2 to 3 times normal (25 mg. to 50 mg.) but the amount of iodine per gram of gland may be equal to or slightly higher than the amount of iodine per gram of gland in normal thyroids. The iodine content of such glands is variable, as may be illustrated by the demonstration of only 9 mg. iodine in an adenomatous gland 40 gm. in weight, obtained from a person who was killed in an accident.

DISCUSSION OF PATHOLOGICAL AND CHEMICAL FINDINGS

As stated, we have conducted chemical and microscopical examinations on 41

of the decrease in iodine content, loss of colloid and hyperplastic changes with desquamation which we noted in the thyroids of animals suffering from severe infections, we anticipated similar findings in humans. It is significant that, although these same changes are observed in the glands of human beings who died from infections, they are not nearly as constant as those noted in animals.

From Table 1 it can be seen that the lowest figures of total iodine in the thyroid are found in patients who have died of illnesses of short duration and severe intensity and usually of an infectious nature (that is, peritonitis, pneumonia, etc.). It should be stated, however, that all patients who have died from such infections do not show such a decrease in iodine content. We cannot predict whether

this is best accounted for by an increased resistance of the thyroid of the human over that of the animal, or by the ingestion of


FIG. 5. Thyroid of a dog injected as animal in Figure 4, but which was given iodine (1 minim per kilo per day) for five days previous to injections, and daily thereafter until it died. Note that a fairly normal architecture has been maintained with colloid of about normal amount. The iodine content was 0.225 mg. per kilo of body weight, still below normal in spite of iodine feeding.

medicines containing iodine. The former explanation seems more logical, but it is likely that both factors enter into the explanation. There is a slight but definite tendency toward a decrease in amount of thyroid tissue per kilo of body weight in patients who have succumbed to acute infections, and a very pronounced tendency toward a marked increase in weight of the thyroid of patients who have succumbed to chronic infections, such as endocarditis, chronic lung abscess, chronic colitis, etc.

We have observed, as did Marine and Lenhart several years ago, that the iodine content of thyroid glands varies inversely with the amount of hyperplasia present. It has also been noted by many observers that the iodine content of glands varies

directly with the amount of colloid. On the basis of this observation it has been concluded by numerous observers that

FIG. 6. Severe grade of desquamation of acinous cells in the thyroid of a patient who died of bronchopneumonia. Desquamation does not occur as readily in the human as in dogs.

the iodine is held in a compound in the colloid and that this substance is the most important ingredient of the thyroid secretion. We have noted, however, that there are numerous circumstances when this assumption is not entirely true. For example, the gland shown in Figure 2 contained about half as much iodine as a normal animal's gland should contain, in spite of the fact that no colloid can be seen in the photograph, or to any appreciable degree anywhere else in the section of the gland. In another instance the thyroid of a patient who had received iodine therapy before death (see footnote, Table 1) yielded a high total iodine content, but separate analysis of 0.75 gm. colloid, removed from the dilated acini, revealed iodine in such a small quantity as to be practically imperceptible. In addition to these findings we have been unable to see (grossly or microscopically),

TABLE I

RESULTS OF IODINE DETERMINATIONS ON GLANDS OF PATIENTS REMOVED AT AUTOPSY (ALL ADULTS EXCEPT ONE)

No. of Cases	Diagnosis	Wt. of Gland (Gms.)	Mg. Iodine per Kilo Body Wt.	Mg. Iodine per Gm. Fresh Gland	Total Iodine
3	Acute peritonitis	19.1	.312	.579	11.066
1	Lobar pneumonia (bilateral empyema)	19.0	.191	.422	8.01
1	Acute peritonitis and nephritis (carcinoma of rectum)	26.3	.182	.277	7.28
1	Acute lung abscess	13.0	.177	.612	7.956
1	Postoperative hemorrhage	5.0	.874	1.014	5.070
1	Pyonephrosis (child of nine yrs.)	5.4	.553	1.90	10.5
3	Bronchopneumonia and general carcinoma	25.6	.293	.591	12.536
4	Bronchopneumonia	28.5	.279	.817	20.109
1	Peritonitis and pyonephrosis (had iodine therapy)	85	.607	.607	51.51
1	Subdiaphragmatic abscess	21.2	.367	1.428	30.273
1	Hodgkin's disease	27.0	.410	.713	19.224
1	Chronic perinephritic abscess (carcinoma of kidney)	73.5	.478	.358	26.313
4	Vegetative endocarditis	39.1	.516	.728	28.347
1	Amebic dysentery	23.5	.481	.778	18.283
1	C. N. S. syphilis	17.5	.192	.875	15.312
1	Lymphosarcoma	19.0	.720	1.970	37.40
2	Septicemia (long duration)	17.5	.664	1.854	32.50
1	Lung abscess (no lipiodol)	27.3	.380	.696	19.003
2	Lung abscess (had lipiodol injection)	32.0	2.063	2.655	92.85
3	Acute tuberculosis	22.7	.587	1.298	29.41
3	Carcinoma without terminal infection	31.8	.553	1.368	30.501
3	Acute cardiac failure	34.1	.326	.611	20.966
1	Chronic colitis* (had iodine therapy)	87	1.383	.636	55.332
41	Total				
6	Normal (vicinity of St. Louis)	24	.373	.933	22.4

*Separate analyses of colloid and thyroid tissue containing colloid were made, and practically no iodine found in the colloid, in spite of the fact that the gland contained .636 mg. iodine per gm. of gland.

any appreciable difference in the amount or appearance of the colloid, in adenomatous glands of patients who have received iodine and in adenomatous glands of patients who have not received iodine, even though the glands of the former contain twice as much iodine as the glands of the latter group of patients. We, therefore, feel convinced that the cells of the thyroid contain iodine not in combination as colloid, but in a capacity which, nevertheless, is of considerable importance physiologically. The absorption of iodine by the thyroid of patients to whom iodine had been administered was first demonstrated by Nagel and Roos[10] in 1902, although it was, no doubt, suspected by Kocher and others.

As stated previously, 36.5 per cent of the 41 thyroids removed at autopsy showed a definite hyperplasia of varying degree. The thyroids exhibiting the greatest amount of hyperplasia were obtained from patients who succumbed either to respiratory infections (pneumonia and pharyngeal abscess) or peritonitis. It should be stated that all cases of pneumonia and peritoneal infections do not reveal this change, but it is nevertheless true that in this series, at least, the advanced hyperplastic changes were not noted in any other group of diseases. Loss of colloid and decrease in iodine content is a quite constant accompaniment of hyperplasia. Desquamation, frequently seen in the thyroids of animals dying from infections, is not encountered so often in humans but is occasionally seen. Figure 6 illustrates a moderately severe desquamation of acinous cells in a patient with a severe cystitis, caused by a carcinoma of the bladder, who died of bronchopneumonia. We feel that desquamation is evidence of the more severe type of damage to the thyroid, since many of the cells thus isolated appear to be degenerating. In many areas there are small clumps of cells undergoing hyperplasia, which presumably have arisen from the cells of acini remaining intact during the process of desquamation, or from the cells of collapsed acini. It seems logical to assume that the damage accompanying desquamation, and possibly also the extreme scarring seen in "woody" thyroiditis, is a step in the development of the myxedematous gland.

In 15 per cent to 20 per cent of the glands removed at autopsy, diffuse and dense scarring was pronounced and constituted the chief pathological change present. Focal invasion of lymphocytes is common but, in no instance, was any leucocytic invasion discernible. Frequently hyperplastic areas were found buried

in scar tissue. In no instance was the exact picture of a "woody" thyroiditis found, but the gland shown in Figure 7 illustrates

who had chronic infections and debilitating diseases such as chronic lung abscesses and endocarditis.

FIG. 7. Thyroid of a patient who died of peritonitis (B. coli) of nine days' duration. Note the extensive hyperplasia and desquamation with only a few acini maintaining colloid, and their normal shape. The dense scarring seen is attributed to previous attacks of unknown nature on the thyroid. It is not difficult to assume that such areas would give rise to adenomas at a later date.

FIG. 8. Thyroid of a patient who died of an acute lung abscess of four weeks' duration. Note that the destruction has not been as marked as in Figure 7, but that the hyperplasia is more advanced.

what may be an early stage of this pathological process, which was first described in 1896 by Riedel, after whom the disease has been named. The mechanism of formation of the true thyroiditis appears to be distributed over quite a period of time and probably consists of the bombardment of the thyroid by such factors as toxic, chemical and bacterial agents. Only in rare instances does the focal implantation of organisms appear to exert an influence in the production of this disease.

Adenomatous structure and colloid type of goiter were encountered in 17 per cent of the 41 cases and routinely exhibited a moderate increase in weight. No relation of past or present illnesses of the patient to the production of glands of this type could be demonstrated, except that these thyroids were usually found in patients

We observed, as has been noted by Sarbach[11] and others, that diseases like carcinoma, sarcoma, neurosyphilis, etc., do not produce any significant changes in the thyroid gland.

Quantitative iodine determinations were made upon 20 goiters removed at operation. Of this number 14 were of the exophthalmic type. Microscopically 12 of this number revealed "iodine therapy involution," emphasized of recent years by Else,[12] Allan Graham, Rienhoff and others. The average total amount of iodine was 48.0 mg., roughly twice the amount found in normal glands. It illustrates the capacity of the toxic gland to absorb iodine. The amount of iodine per gram of fresh tissue is .765 mg. or still lower than the amount per gram in normal glands. The amount of iodine found was roughly directly proportional to the amount of colloid as seen in the microscopical sections except in instances previously mentioned. The cur-

rent assumption that glands deficient in iodine will absorb more iodine than normal glands does not apparently hold true in of 4 patients not having thyrotoxicosis, to whom iodine was given for a period of one or two weeks, was 73 mg. per gland.
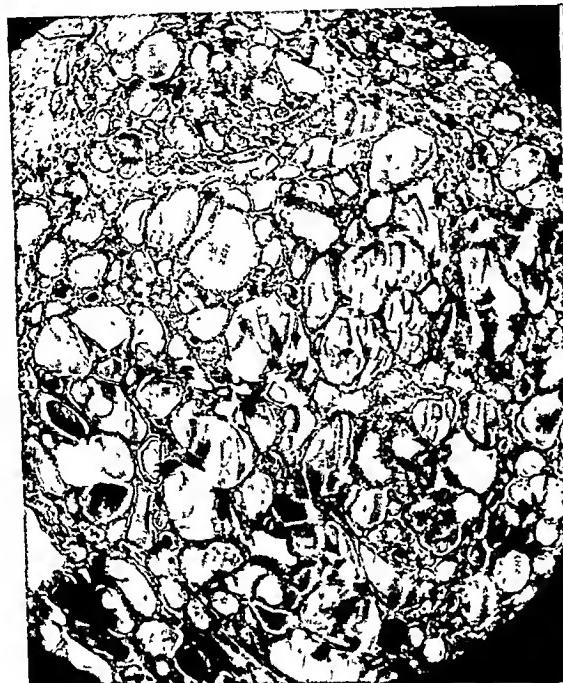

FIG. 9. Non-toxic adenoma weighing 250 g. removed from a patient who had not received iodine therapy. Very little gland left at operation. Moderate amount of colloid visible. The total amount of iodine was 31.9 mg., slightly more than that seen in normal glands, but about the average amount found in non-toxic adenomas as reported by other workers.

FIG. 10. Toxic adenoma weighing 125 gm. removed from a patient who had received iodine therapy. Note that the amount of colloid does not appear to exceed that seen in Figure 9, but the total amount of iodine was 95.7 mg. (Table II). This not only proves that toxic adenomas will absorb large quantities of iodine, but, when considered with the fact that glands without visible colloid such as seen in Figure 2 may frequently contain half as much iodine as normal, suggests that the colloid is not the only iodine-containing substance in the thyroid gland.

the glands of exophthalmic goiter since the average amount of iodine in the glands

TABLE II

No. of Cases	Diagnosis	Gms. of Gland Excised	Gms. of Gland. Total (Est.)	Mg. Iodine per Kilo Body Wt.	Mg. Iodine per Gm. Fresh Gland	Total Iodine (Mg.)
12	Exophthalmic goiter (gland involuted)....	53.8	62.7	.862	.765	48.0
1	Exophthalmic goiter (gland not involuted)..	50 (1 op) 10 (2 op)	58 9.5	.085 .019	.068 .097	3.4 .968
1	Exophthalmic goiter (gland not involuted)...	40	47	.194	.292	11.68
	Exophthalmic goiter (without iodine therapy*)	45	....	.....	.400	18.0
5	Toxic adenoma (iodine therapy)...	104	121	1.234	.741	62.9
1	Non-toxic adenoma (without iodine therapy)	320	380	.338	.099	38.28
6	Normal gland (vicinity of St. Louis)........	....	24	.373	.933	22.4

* On account of the prevalence of preoperative iodine therapy, figures in this group are not available in this clinic now, and an average of figures as found in the literature is hereby listed.

This suggests that in exophthalmic goiter the iodine deficiency is caused, for the most part, by an inability of the gland to

(Table II). The patient with the gland containing 3.40 mg. iodine was operated on eighteen months ago, but returned
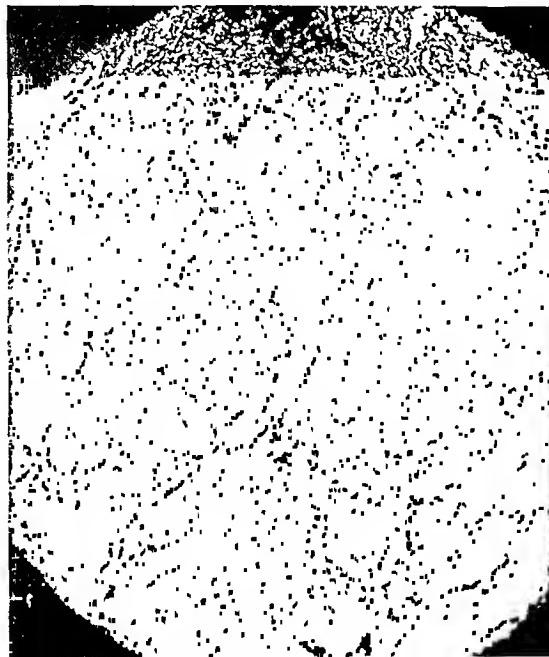

FIG. II. Thyroid removed from a young man with exophthalmic goiter, who had received the routine preoperative iodine therapy. Section shows marked hyperplasia with practically no involution. Very little or no colloid visible. At least five-sixths of the gland removed by operator. Total iodine very low; 3.4 mg. (compare with the normal of 22.4 mg.). This patient returned nine months later with a recurrence of his goiter, which was distinctly of the adenomatous type, both grossly and microscopically. We are of the opinion that such glands not undergoing involution and not accepting iodine when the routine preoperative therapy is given may offer a bad prognosis from the standpoint of recurrence.

FIG. 12. This section was removed from the thyroid of a patient who died following three weeks' illness with a severe pharyngeal abscess. Note that the hyperplasia can scarcely be differentiated from that seen in exophthalmic goiter. Compare with Figure II. Note the similarity in the type of hyperplasia and morphology.

assimilate iodine unless present in excess. Even in the presence of the ingestion of an excess of iodine, the absorption is not as great as in normal glands. It is barely possible that variations in the intestinal flora may be a factor in the deficient absorption of iodine from the intestinal tract.

The glands of 2 other patients with exophthalmic goiter failed to show the involutional changes as noted above, and presented a picture such as was routinely seen in exophthalmic goiter before the day of preoperative iodine therapy. Analyses revealed a total iodine of 3.40 mg. in one gland and 11.68 mg. in the other

nine months later with a recurrence which microscopically was shown to be a typical adenoma. Analysis at this time still revealed a very low iodine content. However, as far as is known he has remained symptom-free since his second operation. The other patient, whose gland had not involuted and contained only 11.68 mg. iodine in the whole gland, was operated on only a few weeks ago. Sufficient time has not elapsed to determine whether a cure has been effected. Needless to say, this patient has been carefully instructed to take Lugol's solution daily for several months during his postoperative course. This has been advised by Else and others as a preventive measure against recurrence.

COMMENT

In other articles[13] we have recently presented data from experiments on the

basal metabolic rate in animals injected with large amounts of toxins and organisms. We found that there was almost invariably an elevation in the metabolic rate in the presence of infections and toxemias, regardless of whether the temperature of the animal was elevated or not. However, a very definite relation between fever and basal metabolic rate was noted, as has been emphasized by Barr and DuBois. We also observed that injection of large doses of histamine produced an elevated metabolic rate without the presence of fever.

An interesting observation was accidentally encountered when the thyroid glands of 2 patients with chronic lung abscess and bronchiectasis were analyzed for the iodine content. The average of the total iodine content of the 2 glands was found to be 92.5 mg. iodine, which is four to five times the normal amount. Investigation revealed the fact that each patient had had several injections of lipiodol into the lungs for diagnostic purposes. The elevation of the total iodine content is so striking that absorption of iodine from the lipiodol seems, without doubt, to have taken place.

SUMMARY

We have observed that following infec-

tions and toxemias of a severe nature, the same changes take place in the human thyroid as occur in the thyroid gland of animals, but to a lesser extent. These changes are loss in colloid, hyperplasia, desquamation of acinous cells and decrease in iodine content. Administration of iodine by mouth is followed by an absorption of iodine by the thyroid glands of patients with exophthalmic goiter, adenomatous goiter (toxic or non-toxic) and normal glands.

Injection of lipiodol into the lungs of 2 patients with lung abscesses and bronchiectasis produced a rise in the iodine content of the thyroid gland, to the extent of four or five times normal. This suggests that iodine can be absorbed from lipiodol, since the amount that escaped into the alimentary tract hardly seems sufficient to produce such a pronounced change in the iodine content of the thyroid. It seems probable that the tendency toward recurrence of exophthalmic goiter after operation can be predicted by the iodine content of the gland and its histological response to iodine. Hyperplasia of the type which can scarcely be differentiated from that seen in exophthalmic goiter is not uncommonly found in the thyroid glands of patients dying from acute infections.

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THE PRESENT STATUS OF ELECTROSURGERY*

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BALTIMORE

TO those of us who have spent no little labor and money in research and the study of the effect of h. f. c.† on animal and human tissue, it is difficult to understand the apparent blindness of the medical profession, physicians and surgeons alike, to the present remarkable therapeutic effect of h. f. c. and what is more important, the as yet undiscovered possibilities of their use in both medicine and surgery.

A careful analysis of the present status of electrosurgery helps in understanding this skeptical attitude of our professional brethren, at the same time pointing out remedies for the failures and suggesting possible future developments.

On the one hand we have enthusiasts with unsound deductions cooperating with manufacturers, who declare their h. f. apparatuses far superior to any other. These as well as "high pressure" salesmen, urge the adoption of their special machines by any doctor who desires to become, in a few days, efficient in the application of h. f. c. in a medical or a surgical way, as the case in hand may demand, and who believes he can do it. On the other hand, after watching these well-meaning and enthusiastic doctors and laymen and seeing their painted Utopias disappearing in the distant haze of the horizon, many of our professional brothers cast away, without further ado, all h. f. apparatuses. With them goes the work of honest, scientific investigators which, as yet, is not complete, time and opportunity not yet having permitted the correlation of the physical and biophysical phenomena with a more thorough study of the local and general body reactions and clinical results.

Comparing this more superficial aspect of affairs with the real situation one finds a fascinating field for scientific investigation. As a basis of foresight and scientific imagination let us take cognizance of the present status of electrosurgery. Neither the scope of my experience nor the limits of this article permit dealing with the medical aspects of the application of h. f. c. Suffice it to say that during the past four or five years strides have been made placing so-called medical diathermy among the therapeutic agents of great value in the treatment of disease.

In the surgical field numerous examples of the superiority of electrosurgery over the ordinary surgical procedures are daily occurrences but, as always with a new method or therapeutic agent, many reactions and important technical points require careful, thorough-going and painstaking investigation. It is to this phase of the problem that I wish to direct attention.

The employment of h. f. c. for surgical diseases began early in the 20th century, about 1907. Doyen, de Keating Hart and Pozzi, in Europe, used the Oudin (mono-terminal) and d'Arsonval (bi-terminal) currents. At the same time Finley R. Cook and later, Wm. L. Clark, in this country, began working with similar currents. More recently has Wyeth popularized the radio-tube current. The field of usefulness, at first limited to benign and malignant accessible neoplasms, has been greatly enlarged. Working with Howard A. Kelly we proceeded to test the value of electrosurgery in any operation where it could be

† h. f. c.: high frequency currents.

legitimately employed without danger to the patient. The current was used in opening gall bladders and intestinal loops, in performing operations on intestines, in removing appendices, in dissecting adherent intestinal loops, in hysterectomies, in salpingo-oophorectomies, in opening the abdomen and in radical amputation of the breast. The technique and results of this work have been, or will be, reported in other places. Ranula, postoperative hernia, Bartholin gland cysts, and other epithelial-lined cavities are treated with a much simplified technique with more prompt recovery. Malignant disease of the skin, oral cavity, lips, antrum, sphenoid sinus, larynx, anus and bladder yield readily to thorough destruction with h. f. c. with rapid, painless healing and soft pliable scars. Deep-seated malignancy, as inoperable glands of the neck and groin, mesentery, pelvis and intestinal wall can be "exploded out of existance," the sterile coagulum being absorbed without difficulty. Much more investigation and clinical work are necessary to demonstrate satisfactorily the ultimate value of electrosurgery in some of these operations.

Pearse, Scott and the author, using laboratory animals, have begun to determine the value of electrosurgery in operations upon the liver, spleen and kidneys. This work like that in other lines of investigation has met with some technical and mechanical difficulties which, however, bid fair to be mastered. Sections of the liver and spleen can be removed, from the dog, without hemorrhage. The more marked arterial blood supply of the kidney renders complete hemostasis more difficult but we have succeeded in materially reducing the hemorrhage in nephrotomy in the dog with primary healing when no infection exists. The 1 or 2 mm. line of coagulated tissue necessary to stop hemorrhage in the kidney and remaining on each side of the incision is absorbed and organized with a remarkably small amount of scaring. This work was carefully checked by scalpel incision of of the opposite kidney (possible in the dog

at the same operation through midline abdominal incision) and microscopic examination at various intervals from eleven days to eight weeks, postoperative. It is still necessary to make careful functional tests of these operatively damaged kidneys to ascertain the amount of disturbance in function due to loss of a portion of the parenchyma, before attempting its use in the human kidney. The question of postoperative infection and consequent hemorrhage must be studied and clarified.

The sterilizing effect of h. f. c. in the electrosurgical treatment of carbuncles has been utilized by several workers. There is marked reduction in toxicity, associated with the sterilization, with prompt granulations and excellent healing. It has been suggested that in acute osteomyelitis sterilization of the cavity might be very rapidly accomplished by the heat of the current with consequent shortened convalescence. The treatment of such acute inflammations furnishes another field of possibilities for electrosurgery.

That granulations spring up rapidly following electrosurgical operations and that healing is more prompt than with other forms of operations causing destruction of tissue are, together with other clinical evidence available, suggestive, at least, of there being some specific electrical effect upon tissue other than that due to the heat. We are all well aware of the biological effects of various wave lengths such as the gamma rays of radium and roentgen ray, ultraviolet and infra-red lights, etc., upon living cells. Recently the United States Public Health Reports have contained evidence of the biological effect of electromagnetic waves. It seems highly probable that h. f. c. passing through living tissue cause some biological reaction within the cells which in turn gives rise to chemical or physical reactions.

We know that much local heat is developed within the tissues as h. f. c. pass through them. To show why this heat is developed and to what part of the current it is due requires the closest cooperation

between surgeon and physicist, in both animal and physical laboratory. Surely there is much unobtained data which will have some definite bearing upon the clinical application of h. f. c. By a thorough understanding of the biophysical and biochemical action of these currents, apparatuses can be developed allowing accurate alteration of these currents to meet our needs. For example: At present I am engaged in working out a technique of intestinal anastomosis without opening the bowel in the operative field but allowing a secondary opening of the united loops within twenty-four to forty-eight hours. The current is applied to destroy the bowel wall at the site of anastomosis but without breaking through into the lumen. After the operation is completed this coagulated line ought to slough through with the intraintestinal pressure assisting. With the aid of the physicist a current might be developed devoid of all faradic stimulation of the bowel at the same time destroying all three coats of the intestinal wall with delayed perforation.

W. L. Clark pointed out, some time ago, the disappearance of one-half of a tumor following electrosurgical removal of the other half. Others have reported similar cases since. This may be the result of an antibody formation or an electrical phenomenon. Who can truthfully say, without scientific evidence?

Another interesting study is the question of hemostasis following "coagulation" of vessels. With capillaries and small veins and arteries we believe hemostasis is due to en masse coagulation of the tissue as the proportion of fluid blood to the perivascular tissue is small. However, there is a difference when coagulating large vessels, where the intima must be approximated permitting of searing together. The question arises as to what part of the vessel is first affected by the heat and what kind of h. f. c. are best adapted for hemostasis as compared to the currents used for other coagulation, cutting and desiccation. At present, I am studying sections of coagu-

lated blood vessels, specially stained, to ascertain how coagulation took place.

After these experimental data are available the next step is to obtain the cooperation of the physicist to design standardized machines producing accurately controllable currents allowing careful observation of the effects of variations in component parts of the current upon the component parts of the vessel walls: intima, muscularis and adventitia.

One great hindrance to the progress of electrosurgery is the lack of standardized high frequency machines. As already mentioned, each apparatus is awarded the first prize of the market by its manufacturer but the ones who buy and use them have no idea of the physical characteristics of the currents produced or their biological effects except that one setting of the machine will produce a cutting current, another a desiccating or dehydrating, and a third a coagulating current. The situation reminds one of many of the proprietary drugs with which the physician is deluged through the mails. On the label are listed the constituents, but no amounts given. Literature accompanies, containing a long list of diseases for which the specific remedy is a panacea. The list is often far too long to be truthful and reliable. Fortunately this condition is not as prevalent as formerly, many thanks to the A. M. A. and allied organizations for their untiring efforts and splendid accomplishments. It is high time that we do the same constructive work for electrosurgery. Let the surgeon refrain from criticism until he has had sufficient experience to render him cognizant whereof he speaks. Rather let him investigate carefully, so that he may constructively criticize, for only by so doing will we "know the truth and the truth shall make us" freer of disease.

SUMMARY

1. Electrosurgery far surpasses former methods in many respects.

2. Further careful research is necessary to place it on a scientific basis of usefulness. This should be done by physician, physi-

cist and manufacturer including physical, histopathological, experimental and clinical study.

3. The above accomplished, the manufacturer will be able to furnish a standard apparatus for efficient use.

4. It is evident that only those surgeons who have taken the pains to study carefully the science and art of electrosurgery should attempt to use it. The surgical societies of the country should take as definite action in this direction as they have taken in establishing the high standard of modern surgery.

5. I urge the establishment in medical schools and larger hospitals of a department of electrosurgery for research, study of clinical data and the instruction of students as to the value, limitations and dangers of electrosurgery.

CERVICAL SALIVARY GLAND*

JEFFERSON BROWDER, M.D.

BROOKLYN

THE occurrence of glandular structures far removed from the normal gland-bearing areas is not an infrequent finding in the human body. In many instances their presence is discovered accidentally, in others because of tumors arising from these cell inclusions, while rarely, attention is directed to an abnormal discharge of fluid due to their cellular activity.

While it is not uncommon to find slight anatomical differences in the human salivary glandular apparatus, it is indeed a rarity to have a salivary structure whose duct empties upon the cutaneous surface.

The object of this report is to record an instance of a cervical salivary gland with its terminal orifice emptying upon the cutaneous surface of the neck.

CASE REPORT

O. C., L. I. C. Hospital No. 24-6825; aged five, entered the hospital November 5, 1924, for "discharging openings" in the front of the neck.

History. His father was said to have optic atrophy and disturbance of gait. His mother had had two miscarriages (third and fourth pregnancies). The first child "had something wrong with his brain" and lived only a few hours. Five other children were living and well.

Patient was a full-term child who appeared normal at birth except for two small cutaneous openings on the anterior surface of the neck. At one month of age the mother noticed a bloody nasal discharge which continued for "several" weeks. Shortly after the discharge stopped there was a generalized cutaneous rash which did not appear on the plantar surfaces. After four weeks the rash disappeared leaving no noticeable skin spots. During the first and second years he was very thin and vomited frequently. He did not walk until past two years of age. He had never talked but apparently understood simple sentences.

Shortly after birth, the mother noticed a thin watery material discharging from the two small openings of the neck. This substance flowed more freely from the right side and she stated that the flow was markedly increased while eating. At no time since birth had the right side ceased to discharge. The opening on the left side had not discharged as freely as the one on the right and frequently a scale formed over the opening. After three or four days the crust fell off and a thick cheesy material was discharged. At no time had there been tenderness or redness about the opening. The condition apparently did not disturb the child in any respect.

Physical Examination. The patient's appearance was that of a child moderately well developed and well nourished. The expression was one of very low intelligence; there was no response when bright colored objects were shown to him nor did he appear frightened when examination was begun. The head was symmetrical but the frontal and parietal regions were rather prominent. The mouth was held open. The hard palate was very narrow and had a high arch. The tonsillar crypts were prominent and several were plugged with a yellowish exudate. The submaxillary salivary glands could be palpated.

At the border of either sternomastoid muscle just at the level of the thyroid cartilages, there were two small cutaneous openings, each surrounded by a pink zone of about 1 mm. which gave one the impression of a mucous membrane. Upon swallowing, the opening on the right side retracted and the surrounding skin moved upward. By pressure over the midportion of the sternomastoid muscle on the right a thin glairy substance could be expressed. By similar pressure on the

left side, a very small amount of similar material was expressed.

The thorax and abdomen were essentially negative. The child walked with a somewhat uncertain step; muscle power of the two sides was equal. Deep and superficial reflexes were equal and active.

Laboratory Examinations. Blood, R.B.C., 4,215,000; W.B.C. 9,300; differential count, normal. The urine showed a faint trace of albumin; rare epithelial cell. Wasserman, (blood serum), negative.

Operation. November 10, 1924. Ether anesthesia. The openings were injected with methylenc-blue.

Left Side. Incision made about the cutaneous openings and by sharp dissection the sinus tract, which extended inward toward the pharynx, was excised. The tract which was well stained with methylene-blue ended blindly about the lateral border of the thyroid cartilage. Wound closed without drainage.

Right Side. A similar procedure was carried out on the right but after dissection had been carried inward for a distance of approximately 1.5 cm. it was noted that the methylene-blue had infiltrated an area about 2 cm. in diameter. The entire mass thus stained was removed with the attached sinus. This stained tissue was situated between the sternomastoid muscle laterally and the postero-lateral aspect

neous surface. Wound closed without drainage.

Postoperative course uneventful. Cutaneous sutures removed on the second day. Primary

FIG. 1. Photograph of child after operation showing scars with moderate keloid formation.

healing of the wound.

Pathological Report #11881.

FIG. 2. Photomicrograph showing collecting duct. A, serous type of acini; B, and C mucous type of acini (×80).

FIG. 3. Photomicrograph showing (A) so-called demilune. ×350.

of the right thyroid cartilage medially at a depth of approximately 2 cm. from the cuta-

Specimen consisted of two pieces of tissue, one a small elliptical piece of skin with a cutaneous dimple and attached to its under surface

some subcutaneous fat with a soft elongated structure 4 mm. wide by 1.6 cm. in length, representing a sinus tract. The cutaneous opening just admitted a 2 mm. probe which could be passed to the distal part of the sinus which ended as a blind sac. The entire inner aspect of the tract was stained a dark blue.

The second specimen was an elliptical piece of skin with a central opening, and a strand-like structure connecting it with a granular mass approximately 2 cm. in diameter. A probe could be passed through the cutaneous opening through the connecting tube and into the granular mass which was held together by a very loose connective tissue. Upon opening the tract its termination could not be definitely made out.

Microscopic Examination. Sections: The sections showed many acini supported by a connective-tissue stroma with scattered ducts lined with low columnar epithelium. These acini were of two types, one composed of large cells filled with a very faintly staining substance which had apparently displaced the rounded nuclei toward the basement membrane; the second type was smaller and more compact, the cytoplasm and nuclei both had taken a deeper stain.

The cytoplasm was granular in appearance whereas the nuclei were filled with a dense chromatin material. Scattered throughout the sections one could see an occasional so-called demilune. The picture was consistent with an active mixed salivary gland and its collecting duct.

DISCUSSION

There are some phases of this interesting and most unusual condition that offer comment which necessarily will be speculative.

Brief mention may be made of the normal salivary apparatus of man which has been conveniently divided as follows:

1. Parotid and paraparotid elements.
2. Submaxillary, sublingual, isthmian and palative glands.
3. Small glands of the lingual, labial and pharyngeal regions.

All these structures arise from epithelial keels or sprouts which develop from the ectodermal lining of the buccal sulcus. By a process of constriction and folding the adult glands are attained with their duct orifices emptying into the buccal or pharyngeal cavities. One exception to this has been observed:

In the buccal sulcus of cat embryo of 9–10 mm. a continuous thickening of its epithelium can be observed. Out of this continuous anlage a cylinder of cells forms which by constriction and separation ultimately becomes widely displaced from the oral epithelium and lies free in the mesenchyma. This is known as the orbital inclusion and the fate of these cells has not been determined.

The detailed studies of Cornalt, Huntington, Schulte, Bujard, Loewenthal and others fails to aid in the explanation of the origin of this cervical salivary structure.

The cervical sinuses were most likely the result of failure of closure of the third branchial cleft. It is reasonable to assume that the salivary structure attached to the sinus on the right side arose from an epithelium keel or sprout of the wall of this sinus. It is hardly conceivable that this glandular structure could spring from the epithelium of the oral sulcus and after separation, similar to an orbital inclusion, assume its cervical position.

Another point of interest was the marked increase of salivary flow through the cutaneous opening during food mastication. This flow not only increased in amount during the early part of a meal which might be explained on muscular compression, but continued throughout the meal. This increased secretory activity was so definitely associated with the intake of food that this salivary structure probably had the same innervation as a normally placed salivary gland.

SUMMARY

A boy of five with probable luetic parents, retarded mental development and bilateral branchial cleft sinuses.

Attached to the sinus on the right side was a salivary glandular structure which discharged its secretion through the sinus to the cutaneous surface. This salivary

structure responded to the stimulus of food mastication. Total extirpation resulted in a permanent cure.

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RECURRENT DISLOCATION OF THUMB. CAPSULORRHAPHY*

Henry Milch, M.D., F.A.C.S.

NEW YORK

SIMPLE dislocations of the thumb at the metacarpophalangeal joint are usually easily cured by prompt reduction. But recurrences, with loss of the power of firmly grasping objects, take place even under the care of the most skillful surgeon. In any case such an outcome is unfortunate but for the laborer it assumes almost tragic proportions because it renders him practically thumbless and unable to earn his living.

Confronted with such a situation several years ago, we were somewhat at a loss as to what to do to restore the power of the thumb. At first, the wearing of some sort of apparatus to limit hyperextension of the thumb was suggested but the patient objected on the ground that it would interfere with his work. We were consequently forced to seek some method of internal fixation. Reasoning by analogy from recurrent dislocation of the shoulder, it was suggested that capsulorraphy be attempted. The result obtained, by an operation which had not to the best of my knowledge been previously reported, was completely satisfactory. It had been intended to delay the report of this case until several other similar instances had been observed. However, the opportunity of treating such injuries is only seldom obtained and it was consequently thought justifiable, at this time, to present the

procedure and the result obtained for the criticism or approval of other surgeons who have been faced with similar problems.

B. K., a mechanic aged twenty-seven, was admitted to the service of Dr. H. Finkelstein at the Hospital for Joint Diseases March 23, 1926, complaining of a loss of power in the right thumb. Some twenty months previously, while walking across a field in Maine, he stumbled and fell forward. The forearm was flexed under his body and the thumb, which had caught in his shirt, was hyperextended and displaced upon the dorsum of the first metacarpal. He was taken to a hospital where the dislocation was reduced. After a short stay at the hospital, the patient was discharged with the warning that "the thumb would be weak for about a year." The weakness which had been forecast persisted for much over a year and was so marked that the patient was unable to use the thumb. He was able to continue at work only by grasping his tools between the index finger and the shaft of the first metacarpal bone. When he attempted to hold a hammer or even a telephone receiver between the index finger and the tip of the thumb in the customary manner, the object fell from his grasp and the thumb rotated outward and backward into dorsal dislocation as shown in Figure 1. The luxation was easily reduced. Within the limits of hyperextension, determined by the recurrence of the dislocation, motion at the metacarpophalangeal joint was painless and free in all directions.

Two days after his admission, operation

under general anesthesia was undertaken. A very excellent exposure of the joint was obtained through a semicircular incision which

FIG. 1. Dorsal dislocation of thumb.

extended from over the first phalanx of the thumb around the web between the thumb and index fingers to the base of the second metacarpal bone. To this a perpendicular incision 1½ in. long parallel to the axis of the first metacarpal was added (Fig. 2.). The capsule was found stretched and slightly thickened over its antero-internal aspect. The lower edge of the first dorsal interosseous muscle appeared to be somewhat thinner than normal and to be attached at a slightly higher level than usual. The capsule was opened by a cruciform incision but nothing abnormal was found in the articular surfaces or in the bones entering into the formation of the joint. The capsule was plicated in two directions and then further reefed and narrowed by passing a purse-string

suture about the entire incision. The lower edge of the first dorsal interosseous muscle was then caught in a suture and fastened to

FIG. 2. Postoperative result showing site of incision.

the metacarpal bone just above the metacarpophalangeal articulation. The wound was closed and a small moulded plaster splint applied to prevent excessive extension. The convalescence was uneventful. At the end of two weeks, physiotherapy and gentle active motion were begun. After three weeks the patient was permitted to begin light work. About eight weeks after operation, he was seen in the return clinic. He informed us that for the preceding several weeks he had been engaged in his usual work and had regained the full power of his thumb. To convince us of his abilities, he grasped the top of a chair between his thumb and the tips of the other fingers and raised and held the chair out with the arm fully extended. He was discharged cured.

The procedure here described is relatively simple and can easily be carried out under local anesthesia. The principle of capsulorrhaphy in the treatment of recurrent dislocations is too well established to

require any comment. Since we have not had the opportunity of operating any other similar cases without the auxiliary reimplantation of the dorsal interosseous muscle, it is impossible to evaluate the importance of this step. Though the insertion of this muscle lower down on the shaft of the metacarpal may have been of value in effecting the result here obtained, it seems that the greatest credit must in all likelihood be attributed to the capsule reefing itself.

AN UNUSUAL CASE OF DISLOCATION OF METATARSAL BONES*

Joseph K. Narat, m.d.

CHICAGO

ACCORDING to Bergmann-Bruns-Mikulicz,[1] Bruns-Garré-Küttner,[2] Lewis A. Stimson,[3] Frederic J. Cotton,[4] H. Helferich[5] and other. authorities, dislocations in the Lisfranc's articulation, namely, in the tarsometatarsal joint, without fractures, are rare. One distinguishes between total dislocations in which all the metatarsals, and partial dislocations in which single metatarsals are dislocated. In 1904 Bayer[6] collected 68 cases, 34 of which were complete and 34 partial. A later collection in 1910 by Grunert[7] contained 113 cases, 58 total and 55 partial. The direction of the total dislocations was as follows: lateral 19, dorsal 14, dorsolateral 15, medial 1, dorsomedial 1, plantar 2, divergent 6. A bloodless reposition was successful only in 40 cases out of 113.

Most of the dislocations of the metatarsal bones are caused by direct violence. The mechanism in the majority of cases seems to be pressure on the anterior extremity of the metatarsals downward, tending to raise the other end of the bones. The mechanism of a lateral dislocation is much disputed on account of the projection backward of the base of the second metatarsal beyond the other metatarsals in the Lisfranc's joint. Malgaigne, Hoffa, Lossen and others assume that lateral dislocation is possible only after fracture or upward or downward dislocation of the second metatarsal. When metatarsal bones are dislocated the dorsal aspect of the foot presents an abnormal bony prominence; the skin on the dorsum of the foot is tightly stretched; a subcutaneous projection of the dislocated bones and an angular deformity at Lisfranc's joint are plainly visible. The foot seems to be shortened and has the form of a pes excavatus.

In our study of the literature we have not found a report of a case similar to the one described below.

CASE REPORT

R. S., an employee of a department store, eighteen years of age, was admitted to the Lutheran Memorial Hospital on October 19, 1928. According to his statement the accident occurred the following way: The freight elevator in the store has a door consisting of two parts movable in opposite directions; the upper one goes up and the lower one down. He separated the two halves of the doors by stepping with his right foot on the lower part and pushing it down; then he pulled the rope which sets the elevator in motion. On account of defective brakes the descending elevator instead of stopping kept on moving and struck the foot protruding into the elevator shaft. As the foot was trapped between the door and the elevator, he had to use considerable force to free his injured extremity.

When the patient was brought to the hospital his right foot had the following appearance: it was forming a very pronounced arch in the metatarsal region, concavity downward;

the proximal ends of the second, third and fourth metatarsal and distal ends of the first and fifth metatarsal were plainly visible,

view. They now lie in contact with the cuneiform bones and cuboideum.

As can be noted from the anteroposterior

FIG. 1.   FIG. 2.

FIG. 1. Anteroposterior view of the foot, showing dislocation of all five metatarsal bones.
FIG. 2. Lateral view of the same foot.

projecting under the extremely distended and bluishly discolored skin of the dorsal surface. The patient suffered severe pain.

The roentgenological findings, described by Dr. A. Arkin were as follows:

Photographs of the right foot and ankle anteroposterior and lateral reveal the presence of a dislocation of all of the metatarsal bones. The proximal ends are torn away from their normal position. The three middle metatarsal bones are displaced lateralward and plantarward. The outer two are displaced upward. In the lateral photograph we note a marked downward displacement of three of the metatarsal bones. The other two are displaced upward. In other words there is a displacement of all of the metatarsals, so that none of them at their proximal ends are in normal position. There is no evidence of fracture.

Photographs of the right foot and ankle after reduction show the proximal ends of the metatarsal bones to be in excellent position, both in the anteroposterior and the lateral

view, the second, third and fourth metatarsals were not only displaced downward and laterally but they were also externally rotated so that the second metatarsal was on the top of the third and the third on the top of the fourth.

Reduction was accomplished under ethylene anesthesia by traction in the direction of the long axis of the foot while direct pressure was exerted on the projecting parts of the second, third and fourth metatarsals. A supplementary manipulation was required to put the first and fifth metatarsals back in place; this was accomplished by pulling on the toes and pressing the proximal ends of the dislocated bones downward.

A moulded posterior plaster of Paris splint was applied to the right lower leg and foot. In view of wide tearing of ligaments necessarily associated with such a grave injury, an immobilization for fourteen days was regarded as indicated. Therapeutic light and gentle massage were applied twice daily. The swelling sub-

sided in five days and complete restoration of function resulted in three weeks.

COMMENT

This case is unusual in two respects:

1. The bones were dislocated in two different directions: there was a plantar dislocation of second, third and fourth metatarsals and dorsal dislocation of first and fifth metatarsals.

2. In addition to a plantar and lateral dislocation of the second, third and fourth metatarsals these bones were also externally rotated, a feature which to our knowledge is not described in the literature.

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SOLITARY CYST OF THE KIDNEY*

JOHN K. ORMOND, M.D., F.A.C.S.

DETROIT

SOLITARY cyst of the kidney is a rather rare condition. Young, in his "Practice of Urology," states that not a single instance had been seen in the 12,500 admissions to the Brady Urological Institute. Recently, Colston reported from that clinic their first case, complicated, however, by a cystadenoma of the kidney.

CASE REPORT

Henry Ford Hospital Case 105,845.

A woman, aged thirty-six, came to the hospital complaining of nose bleed. Six weeks before admission she had had two attacks of epistaxis and in the four days preceding admission she had had several attacks, one being exceedingly severe. She said she had known of the mass in her left side for six months. The only symptom was a drawing sensation when she lay down. There were no gastrointestinal or urinary symptoms.

Examination showed a well developed, well nourished, rather pale young woman with a slight elevation of temperature (99.8°F.). The tonsils were small and there were some carious teeth. The thyroid isthmus was palpable but there were no signs of either hyperthyroidism or hypothyroidism. No general glandular enlargement was found. The heart and lungs were apparently normal and the blood pressure was 114/64. The abdomen showed no tenderness and no masses except that, coming down from under the left costal margin, was a small, round, fairly movable mass, the size of an orange and with the consistency of a cyst, palpable in the flank by bimanual palpation and suggesting a renal origin. The deep reflexes were normally obtained and the extremities showed nothing unusual. Pelvic and rectal examination showed no abnormalities.

Urine examination: specific gravity 1.025, albumin trace, no sugar, no blood, no pus. Two hour phenolsulphonphthalein test, 50 per cent.

Blood: hemoglobin 54 per cent, R.B.C. 3,032,000, W.B.C. 9700. Wassermann negative. Nonprotein nitrogen 28.5. Blood group IV.

She was given a transfusion. There was no epistaxis after admission.

Urinary tract roentgenograms showed a suggestive rounded shadow below the left kidney shadow. No pus or blood was found in the urine from either kidney, and the function of the two kidneys was about equal. Pyelogram showed slight dilatation of the pelvis and calyces on the left but no distortion suggestive of tumor.

Following this examination she had slight elevation of temperature for a few days, and the mass was rather tender. The pyelogram was repeated, the mass being marked, and pushed down as far in the abdomen as possible.

*Submitted for publication June 11, 1928.

By this means it was determined that the mass was not kidney but probably had some connection with the kidney, for as the mass descended

cysts are few in number and confined to one kidney which itself is not extensively diseased.


FIG. 1. Pyelogram.

FIG. 2. Pyelogram with hand pushing tumor downward.

so did the kidney. A diagnosis of probable solitary cyst of the kidney was made and exploratory laparotomy decided upon.

On March 14, operation was done, exploration by left rectus incision. The tumor was found to be a solitary cyst arising from the lower pole of the left kidney. The left rectus was cut across about the middle of the incision, thus giving more room, and the cyst was removed whole, its site being sutured with catgut. A stab wound was made in the flank for drainage and the abdominal wound closed without drainage. The patient has done well since operation.

As stated before, these cysts are not common. Writers differ in their definition of the condition; some include only cases of actual single cysts, others include cases where there are four or five cysts but in which the condition is not bilateral. This type of cyst, producing a large abdominal tumor, occurs nearly always in an otherwise normal kidney. There is no connection between them and chronic nephritis. It seems reasonable to include in the classification of solitary cysts all cases where the
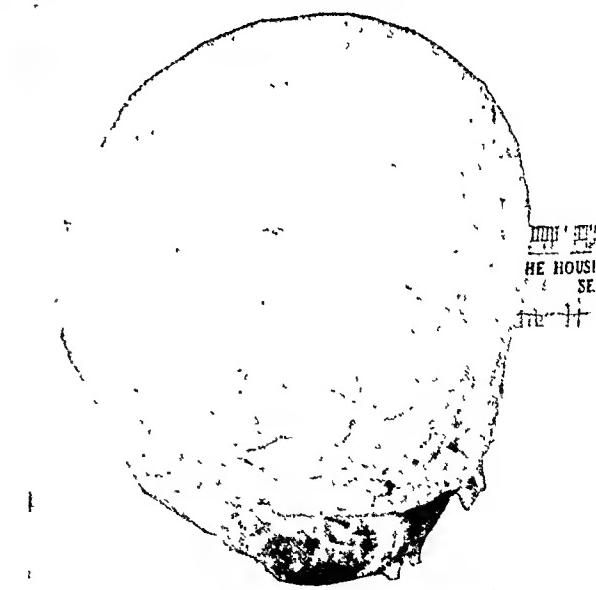

FIG. 3. Photograph of cyst.

These cysts may be found at any age but usually grow slowly and therefore are not discovered until after the age of thirty. Very few instances have been reported

before this age, though one or two have been found in infants. They vary greatly in size, the largest on record containing 12 litres. The condition is found oftener in women than in men.

There are three theories as to their etiology:

1. They originate in embryonal rests.

2. They originate from a failure of union of the glomerulus and tubule.

3. They are retention cysts due to the blocking of a tubule by a localized inflammatory process.

The retention cyst theory is generally accepted. Carson, however, has recently suggested a congenital malformation as the cause of both this condition and polycystic disease.

These cysts usually occur at one pole or the other of the kidney, oftenest the lower, and do not communicate with the calyces but may bulge into them and may press on the ureter. The shell is composed largely of the renal capsule. The contents are usually serous, occasionally bloody, rarely purulent. A few calcified cysts have been reported.

As would be expected, they are symptomless as a rule, except as they cause symptoms by their size and position. They may adhere to other organs or may press on them. Rarely do they press on the ureter sufficiently to cause obstruction. As a rule, the only symptom is the presence of a large abdominal tumor which may be freely movable and which may occur in almost any part of the abdomen. Cysts on the upper pole of the kidney may push the diaphragm up enough to cause respiratory disturbance and those on the lower pole may simulate pelvic tumors.

The differential diagnosis lies between pararenal cysts, hydronephrosis; intrinsic renal tumor, gall-bladder disease, cysts of liver, spleen, pancreas, omentum, or mesentery, ovarian cysts and intestinal tumors. As a matter of fact, the diagnosis can rarely be made before operation.

The treatment is operative, excision of the cyst or nephrectomy. Nephrectomy is done only if excision is impossible or if the kidney is atrophic or otherwise useless. Evacuatory puncture and simple incision have been tried. The first was abandoned because of its high mortality, the second because of the frequency of a persisting sinus. The prognosis from excision or nephrectomy is favorable.

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EDITORIALS

SCARS

THE general surgeon interested in saving life and improving function gives little heed to the psychic reactions resulting from scars. However, the plastic surgeon recognizes the intangible effects of scars and other disfigurements and bends his efforts toward improving the mental wellbeing of his patients as well as their physical condition.

A deformity, constantly exposed to public gaze, produces a psychological reaction on its bearer, which varies with the sensibilities of the individual. Any deformity is more or less of a torment to its owner. This is not a fictitious reaction.

Largely as a result of clever magazine advertising by manufacturers of household articles, the esthetic conscience and artistic sensibilities of the public have been awakened and they now expect better appearing surgery. They demand minimum scars. The surgeon who was once noted for his wide scars must revise his technique. Patients claim the right to be more than merely cured. They demand that they look well. Simply suturing wounds does not satisfy. Cabinet work is demanded where sidewalk carpentry was once sufficient.

Attorneys, liability insurance companies and injured individuals recognize that minimum scars and lessened deformities are preferable to litigation and jury awards.

Patients desire to be as free as possible from evidences of previous injury and while these evidences cannot always be entirely effaced, patients are entitled to the best that modern surgical skill can give.

The modern surgeon must familiarize himself with the principles of plastic surgery and apply them or refer surgery of exposed parts to some one who can treat it as it deserves. Thus will patients receive maximum benefits.

A disfigured person stands out from his associates; he is pointed out by strangers; he is conspicuous at all times; and he, therefore, builds up a mental reaction which hides his abnormal condition from his conscious self.

Disfigured persons often have difficulty in obtaining work and in supporting themselves properly. They are beset by the fear that the condition will become worse; fear of conspicuousness, fear of loss of employment, of friends, associates and social position. They become depressed and not a few develop typical psychoses. They lose the zest of living. Medical literature recites that they have committed suicide when they could bear their disfigurements no longer.

The removal of these mental handicaps is more than justified and the patients are more grateful than many who have been saved from death.

The ethical medical profession must encourage scarred and otherwise disfigured individuals that they have their impairments removed. Ethical physicians must cease to decry the artistic in surgery. Ethical surgeons must treat disfigured individuals as their conditions deserve.

ADALBERT G. BETTMAN
Portland, Oregon

ANNUAL MEETING OF THE AMERICAN ASSOCIATION FOR THE STUDY OF GOITER

THE annual meeting of the American Association for the Study of Goiter will be held this year at Dayton, Ohio, on March 25, 26 and 27. The primary object of this association is to bring together each year men who are especially interested in the study of goiter and its associated problems. Members of state and provincial medical societies are eligible and cordially invited to participate as attending members.

The 1928 meeting, which was held at Denver, was a decided success. Professor B. Breitner of the Von Eiselsberg Clinic of Vienna and Dr. Gulbrand Lunde, professor of biochemistry of Oslo, Norway, were the foreign guest speakers. Drs. H. S. Plummer, S. F. Haines, J. de F. Pemberton and William Boothby of the Mayo Clinic held clinics and presented papers. Among the other contributors to the program were W. Blair Mosser of the University of Pennsylvania; W. H. Cole, N. A. Womack and S. M. Gray of Washington University, St. Louis; A. E. Hertzler, Halstead, Kansas; J. L. De Courcy, Cincinnati; Allen Graham, Cleveland; H. M. Clute of Lahey Clinic, Boston; J. Tate Mason of Mason Clinic, Seattle; and Willard O. and P. K. Thompson of the Massachusetts General Hospital Thyroid Clinic.

The first day of the Dayton meeting will be given over to diagnostic clinics in the morning and several short papers during the afternoon chiefly concerned with recent experimental work. On the second day, operative clinics will be held at the Miami Valley Hospital, St. Elizabeth's Hospital and at the Soldier's Home Hospital. The afternoon of the second day and the morning and afternoon of the third day will be given over to the presentation and discussion of scientific papers.

The headquarters will be at the Hotel Miami. Dr. William A. Ewing is President of the Montgomery County Medical Society under whose auspices the meeting is to be held. Dr. E. M. Huston is the General Chairman of the Committee on Arrangements. Dr. H. C. Haning is Chairman of the Hotel Committee. All communications in regard to hotel reservations should be addressed to Dr. Haning at the Reibold Building, Dayton, Ohio.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

HISTORIC ARTIFICIAL LIMBS

V. PUTTI, M.D.

· BOLOGNA, ITALY

PART II*

PROSTHESIS D (STIBBERT)

NO. 3317. Fifteenth century [?] Weight 840 gm. (Fig. 7).
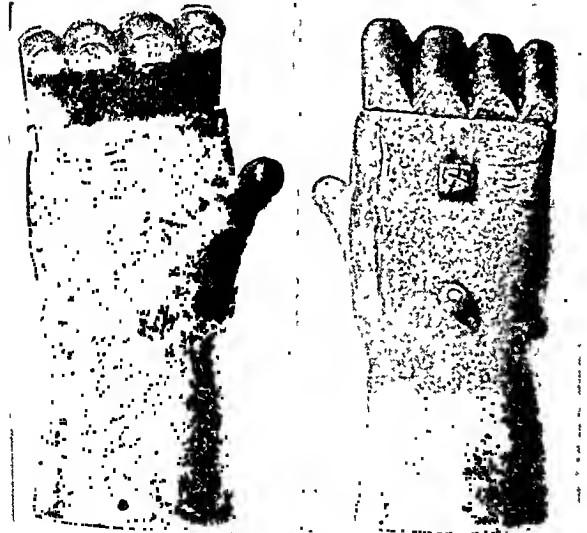
FIG. 7. Prosthesis D (Stibbert).

This prosthesis is a small, rough, heavy apparatus for the right hand, which, like the one last described, seems obviously a working apparatus alike by its form, structure and the neglect of esthetic considerations.

* This concludes Dr. Putti's article, the first part of which appeared in Bookshelf Browsing, AMERICAN JOURNAL OF SURGERY, January, 1929, Vol. 6, No. 1, p. 111.

It is made of large metal plates and is formed of two distinct portions: One comprising the lower third of the forearm, the wrist and metacarpals and to which is soldered an embryonic thumb without phalanges, although a nail is inscribed; the other formed by the fingers, which are fused together.

The joint between the two parts is formed by a simple cross pivot, attached to the metacarpal part. It is interesting to note that, although the construction is primitive and clumsy, the workman has guarded the normal inclination of the metacarpophalangeal articulation and not made it horizontal as in other more elegant machines, but kept it oblique as in life.

The thumb, which is ridiculously small in proportion to the other fingers, is abducted sufficiently to allow full flexion of the fingers into the palm. The fingers, as noted above, have no interdigital spaces, but are fused together and all equally flexed like claws. Their palmar surface which is flattened, forms a plain cylindrical curve. Passive flexion of the fingers, which in its maximum brings the pulp within $1\frac{1}{2}$ cm. of the palm, occurs in four stages. In one of these the movement is irreversible. The space, broken into by the thumb, although naturally diminishing in size with progressive flexion, keeps throughout the shape of a heart in a pack of cards. The irreversibility of the various movements of

flexion is guaranteed by a ratchet cut in the pivot, which bears the fingers, this being held by a spring controlled through a button projecting on the dorsum of the hand. Opening of the hand occurs automatically, as soon as the lever is blocked, by pressing on a button which works two springs that act on the rod to which the fingers are attached. Four small holes in the proximal edge of the forearm cuff suggest that the hand was indirectly fixed to a short stump by means of an intermediate segment, probably of wood, as they were evidently severed for screws or nails.

The workman who so roughly moulded this hand evidently felt the necessity of giving it some accuracy of form, as he marked conspicuously the ulnar styloid process.

There are many signs that this hand was much in use.

PROSTHESIS E (STIBBERT)

No. 3818. Weight 620 gm. (Fig. 8).

This is for the right hand. Two troughs of sheet-iron, joined by rivets, form together the wrist and metacarpal segment. On the thenar part of the palmar gutter is fixed, by means of hinges, the thumb, which (the first of its kind among those described) has an interphalangeal articulation whose detailed structure is not recognizable from the outside as it is ankylosed by rust, but it is probably by a hinge. On the palm and dorsum of the hand numerous holes arranged in graceful figures are evidently placed to lighten the apparatus. The fingers, distinct from one another in their movements, are mounted on a single horizontal rod, which is fixed to the metacarpal part. The fingers, tubular in form, are rigidly flexed like claws in the interphalangeal joints. The ring fingers lack the terminal phalanx.

As the machinery is partly missing and the rest rusted and spoiled, it is difficult to understand how the hand worked. It would seem that the maker intended to keep separate the movements of the two

pairs of fingers, a feature which would give this apparatus special importance as a homologue of the Alt-Ruppin and Wilozel

FIG. 8. Prosthesis E (Stibbert).

hands. The controlling button is placed on the outer margin of the hand at the level of the root of the thumb; but unlike the arrangement in other hands the rod to which the button is attached, and which evidently had to control a lever or spring working the two outer fingers, was not made to free a ratchet or allow automatic extension of the fingers, as in the previous cases, but to keep up flexion of the fingers when it was pushed proximally, and to allow extension when it was pushed distally. To keep it in the first position, there is a little hook to be worked by the good hand, and which by gripping the neck of the button, prevents it from moving distally, thus stopping extension of the fingers.

The hand was joined to the stump, or to a forearm-piece by four metal strips whose ends remain.

Everything suggests that it was not subjected to much usage.

PROSTHESIS F (STIBBERT)

No. 3820. Sixteenth century. Weight 1480 gm. (Fig. 9).

This is a left lower-limb designed for esthetic purposes. That it is so, and was probably intended to conceal the mutila-

knee is perforated with large openings in the interests of lightness, and these would have left unprotected any stump within;

FIG. 9. Prosthesis F (Stibbert).

tion of a knight on horseback seems clear on several grounds. The fixation of the foot to the leg, the difficulty of getting a stump into the leg piece, the impossibility of completely extending the knee and finally the shortness of the thigh part, would not have allowed the maintenance of the erect position, nor would they have allowed walking. Furthermore, the system of suspension, which is mainly intact, would not have secured union of the apparatus to the stump and to the body sufficiently firm to prevent its weight dragging it off at the least movement. On the contrary if one supposes that the limb served for a long thigh or short leg stump, held in the position of knee-flexion required for riding on horseback, then the construction of the apparatus appears logical. The supposition that the apparatus was made for a thigh stump is borne out by the consideration that all the part below the

whereas the knee and thigh are shielded by strong metal plates. It is safe to suppose that the leg and foot were hidden in a leg piece or boot of thin metal.

To describe the apparatus more minutely: The foot is fixed to the leg at an angle of 100° equinus; only the front part of the sole has a metal cover, in the rest is nothing; a series of holes all round the margin of the foot suggest that the posterior two-thirds of the sole were padded with stuff or leather.

For suspension of the apparatus there were undoubtedly, in addition to the horizontal straps seen in the plate, which certainly were added at a later date, other straps attached to three holes in the posterior plate of the knee-piece, and perhaps another boot-strap attached to the metal button which is found on a jointed plate in the popliteal part of the apparatus.

PROSTHESIS G (ZUCCHINI)

Section 17. Weight 1660 gm. (Fig. 10).

As already stated, this apparatus is the property of the engineer Dino Zucchini of Bologna, who acquired it as a family legacy. It was made for the use of a Marchese Francesco Maria Riario, remote descendant of the Girolamo Riario who married Caterina Sforza, who lived in a palace on his estate called "Giardino," near Castelguelfo (Bologna) and who died at the age of sixty-one in 1676. The property, about the middle of last century, passed into the hands of Dr. Giovanni Zucchini, grandfather of Dino.

Francesco Riario was buried in the parish of Giardino. In the church there is to be seen a stone bearing the inscription: Ossa Marchionis Francisci Mariae Riari—MDCLXXVI.

In order to ascertain for exactly what type of mutilation or deformity this apparatus was constructed, a thing not easy to guess as will be pointed out shortly, I requested and obtained permission to open the tomb of Riario. But my hopes were disappointed; under the stone there was no trace of a tomb. Therefore, we must be content to draw conclusions as to its use from an examination of the apparatus itself.

It may be said at once that it is generally believed there is no possibility of error in affirming that it was meant for the right limb. This is open to discussion, but the conclusion seems logical if we consider:

1. That the manufacturer, although somewhat rough as an artist, has tried to give some elegance to his work by shaping a malleolus at the ankle and as the external, or fibular, malleolus is normally the most prominent this is the one which he has accentuated.

2. If one applied the thing to a left limb, the foot would lie in extreme external rotation, which would be unpleasing esthetically and injurious for the function of the limb; whereas on a right limb it adapts an inward inclination which is desirable from both points of view.

3. If the apparatus were meant for a left limb, it is difficult to see the purpose of a large opening on one of its sides, which seems adapted to leave room for the pro-

Fig. 10. Prosthesis G (Zucchini).

jection of a right foot in varus and adduction.

The apparatus consists of two parts: the leg, made of large metal sheets; the foot, which is continuous with the lower third of the leg, and made of wood. The foot is cut out roughly from poplar wood. Its tarsal part on which most weight falls, is reinforced with a swallow tail inlay on either side. There is interposed between foot and leg a wooden disc to which the metal legpiece is fixed with large nails. The leg is fixed to the foot by means of two long and strong bars of metal, one on each side of the apparatus. The legpiece, of tubular form, is deeply excavated in the popliteal region and has at its upper end in front two wings, moving on hinges and serving to give a firm grip of the upper part of the leg immediately below the knee. The leg is perforated with many

openings, some round, some rectangular, intended to reduce the weight. A large one, oval in shape, occupying most of the medial aspect of the apparatus, presumably allowed projection of the foot, lying almost at right angles to the axis of the limb in adduction. A row of holes along the edge, characteristic of all old apparatus, enabled the lining or padding of the interior of the socket to be sewn to it. There is no evidence to show how the limb was fixed on. The length of the leg from the bearing surface of the heel to the lowest part of the popliteal excavation is 41 cm., and to the outer wall of the movable wings, 52 cm.

For what deficiency, deformity or mutilation could this apparatus have served? At the Congress of the Societa Italiana di Ortopedia, held in Rome in October, 1923, I spoke about this apparatus and brought forward the hypothesis that it was made for a deformity, not for an amputation. My principal arguments were as follows:

1. The shape of the apparatus. If it had been for a leg stump, there would be no reason why it should be so wide in circumference opposite the end of the stump, i.e., just where the leg stump is most slender.

2. The existence of the large oval window in the inner wall, an opening which can only be explained by supposing that it allowed the projection of a part of the limb enclosed within the apparatus, most probably the end of a foot twisted into adduction and supination at right angles to the axis of the leg.

I concluded that the most likely explanation was that the apparatus was made to compensate the shortening and hide the deformity of a congenital malformation, most probably an absence of the tibia with resulting medial deviation of the foot at an angle with the leg. The hypothesis of a simple, congenital clubfoot, or poliomyelitic deformity would not account for the extreme shortening, which the apparatus was evidently built to compensate. Further researches, since

carried out, seem to me to confirm this hypothesis in great part.

Francesco Maria Riario was one of the three sons of the Marchese Alessandro Ferdinando, direct descendant of Galeazzo, seventh son of Girolamo Riario and Caterina Sforza, by his marriage with Laura del Conte Gerolamo Pepoli (1608). As the pair were second cousins (Raffaello, father of Alessandro had as his second wife a Pepoli), a dispensation was necessary for the marriage.

Ghiselli in his Cronaca Manoscritta[11] says that: "The Marchese Alessandro was unfortunate in his wife, who bore him three sons, the first deformed in the hands and feet, although he was able to walk and write. The other two deformed completely."[12]

We comment in the footnote on the accuracy of this information furnished by Ghiselli, but the part of Ghiselli which cannot be contradicted is that the three sons of Alessandro Ferdinando Riario were born deformed from a marriage of near relations. There is quite sufficient evidence to support our hypothesis, that is that the apparatus, which was evidently made for the one of the three sons who, according to Ghiselli, had the best functional condition (on the other hand the expression "completely deformed" does not in itself exclude the possibility that the other two sons could get about somehow) and was intended to mask and compensate for a congenital deformity, not a mutilation.

Let us now consider the answers to certain questions which the study of these prostheses suggests.

First we must ask whether these antiques ever served any useful purpose, or merely remain as monuments to the sporadic attempts of some industrious mechanics. This question is answered by history, which although it is not actually rich in information, and indeed is very poor in documentary evidence, yet gives us certain proof that, at any rate after 1400,

the problem of apparatus for the upper-limb has been studied with definite finality, and, as appears, with considerable success. Even if we allow that some of the apparatus described above was never used, yet it is clear that in its construction, the workman had before him a definite aim, either functional or esthetic. Thus numbers c and d (Stibbert) are magnificent and perhaps unique examples of what we should call nowadays working hands. We say magnificent hands, because in them are to be found the essentials of a good tool: resistance to any force, good grasp, simplicity of mechanism, sacrifice of every esthetic consideration in favor of that of function. If these two limbs were made, as is probable, for forearm stumps, they must have been of the greatest use to their possessors. The same can be said of the prosthesis b (Poldi-Pezzoli), strong, well-balanced, with an excellent grip, if, as already noted, it were not made for an upper-arm stump.

On the other hand, prosthesis a and f are two interesting examples of esthetic apparatus. The warrior loved to conceal his mutilation, and the instrument maker prepared him an apparatus that would conceal it in the best way, either as in a, by copying the armor of the lost limb, or as in f by making a metal skeleton, which like Paré's pilon would activate the armor.

As to the mechanisms, in four out of the five hands, they have a common denominator: the now abandoned device of two antagonistic levers, sure and durable, although primitive and noisy, designed to spring the fingers into extension automatically and allow a graduated, irreversible flexion. Only in hand c, the workman —*homme de bon esprit*, as Paré would have said—attempted to show greater skill. Perhaps from some knowledge of watch-making, or of the arquebus, he made use— as had "petit Lorrain" before him—in the elbow-joint of the device, of a spiral spring and succeeded in hiding the mechanism and protecting it. Also to be noted is the diverse technique employed in the elbow

mechanism of prostheses a (Stibbert) and b (Poldi-Pezzoli). To sum up, here we have none of the mechanical ingenuity of Goetz' hand or that of "petit Lorrain," but there is a more practical, though less ingenious conception of the problem.

As to the morphological standards according to which these hands were constructed, we noted that four out of five had a rigid thumb. The only one with a jointed thumb is prosthesis e (Stibbert) which has less esthetic and functional value. The fixation of the thumb certainly limits the uses of the hand and the adaptability of its grasp, but it gives increased security and simplifies the construction. Indeed, it is a solution to which many modern constructors have come, feeling that for a working grasp, the most important function of the thumb is to act as a resistance in opposition to the closing of the other digits. In three of these five hands, the palmar surface of the fingers is flattened, rather than semicylindrical, the result of which is that the grasping area is triangular on section. This seems to us the best method for holding irregular or cylindrical objects.

We will not linger over the two fittings for the lower limb, as enough has already been said. May we just be permitted to recall the fact that prosthesis g (Zucchini) is, as far as we know, the only one so far discovered as a concrete example of apparatus for a congenital deformity.[13]

It would be interesting to be able to fix some definite date for these pieces of apparatus. Of one alone, that of the Marchese Francesco Riario, we know that it was made between 1615 and 1676, most probably nearer the middle than the beginning of the seventeenth century, seeing that it was used by the Marchese when an adult.

Of all the others little or nothing is known.

The Alt-Ruppin hand, the most ancient, is supposed to date about 1400. Our research has not shown on what date or conjecture this is based. Karpinsky's definite assertion lacks any confirmation at

all. Possibly the bits of armor, dug up with it from the Rhine mud, were the cause of the suggestion; but neither Gurtl nor Karpinsky, who published a drawing of the apparatus, give any space to a discussion of its date, just as they neglect to give the mechanics of it. An analogy exists between the forearm of the Alt-Ruppin apparatus and that of Goetz. Both are roughly conical without anatomical balance; both are jointed at the wrist by lateral hinges. In the Alt-Ruppin one the fenestration is worthy of notice with the parallel rows of rectangular openings placed in the long axis of the limb.

Of Goetz' apparatus and that of "petit Lorrain" we know for certain that they were made in the first half of the sixteenth century. But let us say at once that none of the apparatus we have studied, nor any other yet known, unless perhaps in certain respects the Alt-Ruppin one, can be compared in its essentials with the hand of Goetz, which represents in our view a unique and unrivalled one. It is as if one tried to date a jewel or medal by comparing it with a jewel of Benvenuto, or a medal of Pisanello. The armorer of Holnhausen was not and could not be imitated, because his ingenuity was exceptional for his day.

It seems certain to us that in the fifteenth and sixteenth centuries those who made limbs and orthopedic apparatus, were either armorers (makers of cuirasses, arquebuses and swords), or else they could not get away from the influence of an art which was widespread in those days and had attained great importance and perfection, especially in Italy and Germany. How can one help recognising the style, decorations and mechanism of armor in the apparatus depicted in the works of Hans von Gerensdorff, Walter Riff, Fabritius of Hylden and above all in the grand and mysterious oplomoschion od Fabritius of Acquapendente?

On other grounds it is certain that the constructor of Goetz' hand was an armorer. Those who made our apparatus A and G

were certainly cuirass makers for in these the esthetic and constructive influence of the armorer is too evident to need comment. But even when, as in the case of "petit Lorrain" the workman was not an armorer (locksmith, Paré calls him) he gave the apparatus the structure of armor, possibly, one thinks, because his client was a warrior; but also certainly because he found already solved in armor, problems of mechanics, arrangements and other details which it was easy to copy.

Thus in judging of the date of an apparatus of the fifteenth, sixteenth and in part seventeenth centuries, we consider it wisest to be guided by considerations of corresponding armor. In that way one goes from the known to the less known, for much is known about old armor. We should gladly apply this principle to the chronological classification of these prostheses, were we not withheld by our incompetence. We will therefore be content with a brief summary.

SUMMARY

Prosthesis A (Stibbert) is doubtfully assigned in the catalogue to the fifteenth or sixteenth centuries. If we remember that the arm-piece "alla moderna" (volume 12), appeared in armor near the beginning of the sixteenth century, and that probably it was adopted in the construction of limbs after it had become general in armor, we may argue that prosthesis A belongs definitely to the sixteenth century, possibly not to its early years. We have already referred to the resemblance between the pattern of the fenestration of prosthesis B and that of the Kaiserliches Museum. This fenestration, which to this day is used to lighten artificial limbs and orthopedic apparatus, was even more important in those made all of metal, where weight became a serious problem.

The cut, balance and design of the fenestration may be said to depend on the taste, experience, technical ability and artistic sense of the workman. Rough, geometrical in the Alt-Ruppin hand, these

openings become decorative features in prosthesis B·and in that of Kaiserliches Museum prostheses and also prosthesis E. Of course these simple designs are not to be compared with the beauty of engraving nor of jewelling, but still they show in their designer a more advanced and mature sense of art. Therefore it may not be incorrect to consider all these as of later date than that of Alt-Ruppin.

In prosthesis B the taste for ornament induced the workman to nail on the anterior trough of the armpiece an elegant but useless rosette of metal, identical in form and size with those to be seen on the magnificent cuirass of the Museo Stibbert (Cat. 2:141).

For hands C and D we agree with the dates assigned them in the catalogue of the Museo Stibbert, that is fifteenth century, although it is difficult to decide because, as everything has been sacrificed to efficiency, there are no esthetic elements for comparison.

In conclusion these old limbs, which we have described, show that from the fifteenth to the seventeenth century not only were there attempts to restore to cases of war injury the limb lost on the field of battle so that the warrior might suffer as little as possible in appearance and efficiency, but also they tried to help the manual laborer and the cripple.

The problem of prosthesis, attacked by artizans not specialising in it (armorers, smiths, watchmakers, and possibly patients themselves) could only in exceptional cases be solved by standards and methods which can withstand modern criticism and give us new ideas. Nevertheless one cannot fail to recognise that some of the pieces described have more than a purely historical value. In some one perceives the nucleus, although primitive and crude, of the principles applied in modern prosthetic work.

REFERENCES

[11] 23: 334, University Library, Bologna.
[12] Montefani ("Genealogical trees of noble Bolognese families," a manuscript in the Royal University Library

at Bologna) gives as children of the marriage of Alessandro Ferdinando Riario and Laura Pepoli, three, of whom two were males Raffaello and Francesco Maria, for whom the limb being described was made, and one female Francesca. The two chronielists thus agree in the numbers, but not in the sex of the children. While the former says that all three were males, the latter declares that the eldest, Raffaello had a wife and four children; the second remained a bachelor (the one with whom we are concerned); the third, a female, married first the Marchese Annibale Campeggi and afterwards Carlo Varano, a nobleman of Camerino. Given that the two chronielists agree in the numbers and that one of the three children was undoubtedly a woman, one must conclude that Ghiselli is the inaccurate one. Another consideration makes us lend more faith to Montefani, namely that while Ghiselli collects and copies information that he either finds written elsewhere or that he gets from contemporaries and from tradition, Montefani has passed on to us genealogical trees based largely on certificates of birth, marriage or death and therefore he must be trusted more than the former.

That Raffaello and Francesco, although completely deformed, were able to marry does not surprise us when we remember that their family bore the name of Riario.

[13] In the Museo Stibbert (Nos. 3820–3825) and in the Museo Poldi-Pezzoli (two exhibits) there are small legpieces of perforated iron, some jointed at the knee and foot, which are supposed to have been orthopedic apparatus for children. One of these in the Poldi-Pezzoli ends in a sandal or slipper of leather. After careful examination of these leg-pieces the conclusion has been reached that they were wrongly so considered. It is much more probable that they formed part of small suits of armor, which on festive occasions, at reviews and at tournaments were worn by the children of rich soldiers, condottieri, and princes. This is confirmed by the portraits of the fifteenth and sixteenth centuries.

BOOK REVIEWS

Here is a good practical handbook on Syphilis of 300 pages and the necessary illustrations.[1] The essential quality of such a book is quick reference. In this the reader will find himself handicapped by the complete lack of an index, a fault that should be remedied in the next edition. This is the first volume of "Harpers Medical Monographs," edited by Dr. Ralph G. Stillman, who says in the introduction that these volumes "are being published to meet the demands of those who have not been able to utilize the stored up treasure of expensive works because of the demands of practice. They will be practical, presenting the essential features of each subject in such form as to make them easily available. And with the other advantages they offer, the publishers hope that they will constitute a definite service to

[1] Syphilis. By Charles C. Dennie, M.D. 12 mo, cloth Pp. 314, illus. N. Y., Harper & Bros., 1928.

the public at large." It seems to us that we have heard the changes rung on this blurb since we first were in the market for medical books.

But it is an end that is highly to be desired and if Messrs. Harper can attain their high ideal, they will deserve the undying gratitude of the profession. They have made a good start with Dr. Dennie's volume, which is short and to the point and withal complete. We shall look with interest for the future volumes of the series.

Urology[1] is just the sort of book one would expect from Dr. Keyes. This is a way of saying it is a good book. In fact it is a book that well can be ranked as: Excellent, plus!

But anyone who knows Dr. Keyes and his background would be disappointed were he to do a work in any but the highest plane of excellency and thoroughness possible.

One need not debate Dr. Keyes' training. Probably it is the fortune of few men to have had the training, over a long period of years, for a certain specialty of medicine that has been Dr. Keyes's lot. Dr. Keyes would have made a journalist of the first water. He knows how to write lucid, terse, delightful English. It is a pleasure to follow him from page to page.

Why discuss what has been covered in the subject matter? Does it not suffice to tell you it is thorough, up-to-date, modern and a book that may be used as a reference work by the surgeon, a good book for the internist to read, and just the book for the general practitioner who should and must know something about urology in order to practice intelligently.

Yes, we could criticise, nothing done by mortal man is perfect. But the minor criticisms we would offer are so overshadowed by the great worth of the book that we keep silent.

In our humble opinion every physician should possess Garrison's History of Medicine. Once he becomes interested in medical history he will discover no end of fascinating works on various angles of the subject.

We also, recommend A Short History of Medicine from Charles Singer's pen.[2] It is especially valuable to the one who knows little or nothing concerning the history of medicine and wishes to get a general knowledge of the subject before undertaking larger and more detailed works. The book has been written with this in mind. It, also stresses the principle of medicine rather than the details of practice.

Charles Singer knows how to color his details and infuse into his paragraphs that intangible something that keeps one reading, loath to put the book aside and go to bed. (We read it in bed in two nights.) When we finished our inward verdict was "Splendid . . I must tell others about it." In a way that's the test of a book worth while. And so, I hasten to publicly proclaim that it is a book every physician and historian and generally cultured person should own.

Here is a book we recommend to all physicians.[1] It is a cure for the blues. It deals with the tragedies and the comedies that are daily being enacted in the home, hospital and consultation room. One meets all kinds of humanity. Physicians will see themselves reflected in the pages.

Consider the first paragraph: "January 1st. Started the new year wrong by ushering in two more drags on the Browns—the sixth twin in nine years."

And so on.

Strictly Private is a book that will be read with laughter and chuckles by the physician. Also, it will be read by every member of the physician's family. It does not pretend to be anything but a reflection of parts of every doctor's life and in this it is successful.

The moment one starts to review Surgical Anatomy[2] he recognizes the educational background of the author. We could wish that this statement might be made as positively of American books as of English.

The author has condensed the question of surgical anatomy by practically eliminating all anatomical discussions excepting those that have a definite clinical value.

This naturally adds to the value of the text presented, but at the same time leaves much to be desired because of the elisions necessitated in such a presentation. A one-man concept of clinical values, the reviewer feels

[1] Urology. By Edward L. Keyes, m.d., ph.d., f.a.c.s. Ed. 3. 8vo, cloth. Pp. 782, 204 illus. N. Y., D. Appleton & Co., 1928.

[2] A Short History of Medicine. By Charles Singer, m.d. 12 mo, cloth. Pp. 392, 142 illus. N. Y., Oxford University Press, 1928.

[1] Strictly Private. By Maurice Chideckel, m.d. The Stratford Company, Boston, Mass., 1928.

[2] Surgical Anatomy. By Grant Massie, m.b., m.s. (Lond.), f.r.c.s. (Eng.); 8vo, cloth. Pp. 413, 121 illus. Phila. Lea & Febiger, 1928.

to be necessarily subject to limitations which should not be imposed upon a subject of as essential a basic value as the one the author is discussing.

The illustrations are, in the main, satisfactory; although, in what the reviewer admits to be a hasty survey of the book, it is evident that a better selection could have been made in some instances, if the author's idea was that the primary value of illustrations is both amplification and clarification of the text matter.

The introduction of both the Old and the A. N. B. nomenclatures is a point, the value of which might well be considered by other authors.

This[1] is the ninth and concluding part of a work begun in 1917. Nothing can be imagined more desirable than a collection of authoritative monographs on diagnostic and therapeutic errors and how to avoid them. Of course it is too much to hope that any such work should be complete enough to satisfy everyone. The defects of the work, however, are those of omission only, and we feel that every surgeon will be the better for a thorough study of this work and will want to have it at hand to brush up on every so often. This particular number covers the gastrointestinal tract and does it well.

BOOKS RECEIVED

All books received by The American Journal of Surgery are listed in this column as soon as possible after their receipt and this must be considered as adequate acknowledgment. Books that the Editor considers of special interest to our readers will be reviewed in a later issue.

ACTA CHIRURGICA SCANDINAVICA, Vol. LXIV, Supplementum X. Pathologico-Anatomical and Clinical Investigations of Fibro-Adenomatosis Cystica Mam-

[1] DIAGNOSTISCHE UND THERAPEUTISCHE IRRTUMER UND DEREN VERHUTUNG. Chirurgie. By J. Schwalbe, M.D. 8vo, paper. Pp. 317, 140 illus. Leipzig, Georg Thieme, 1928.

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ELECTRODESICCATION & ELECTRO-COAGULATION IN NEOPLASTIC & ALLIED DISEASES OF THE ORAL CAVITY & ADJACENT PARTS*

CLINICAL, PHYSICAL, HISTORICAL & PHOTOGRAPHIC STUDIES BASED UPON 20 YEARS' EXPERIENCE

By William L. Clark, M.D.

PHILADELPHIA

ELECTROTHERMIC methods have a definite field of usefulness in the treatment of neoplastic and allied diseases within the mouth and adjacent parts. One who depends upon any single method, however, may hope to attain but a limited degree of success.

Experience has taught me that operative surgery, electrothermic methods, radium and roentgen rays are all factors of such importance that none of them can be eliminated. All these are employed in my hospital,[1] either alone or in combination, to meet particular indications, and if it became necessary to eliminate any one of them, I would be seriously handicapped.

I hold no brief for any particular method, but experience has demonstrated to me the extreme importance of electrothermic methods. I consider them second to none, and, in many emergencies, superior to all others.

It is my desire to emphasize the importance of electrothermic methods without detracting from the others, devoting this paper to a discussion of the rationale, instrumentation, technique, clinical observations and histologic findings, with indications for and contraindications to their employment. The types of cases in which electrothermic methods stand supreme will be stressed, and a sound basis for their employment will be demonstrated.

ELECTROTHERMIC METHODS

Two tissue changes produced by high frequency currents will be considered. These are classified descriptively, in accordance with the actual effects produced in the tissues, as desiccation and coagulation.

The Desiccation Method. The desiccation method is one by means of which benign and malignant growths of small or moderate size may be destroyed by the utilization of heat of just sufficient intensity to desiccate or dehydrate the tissue. The heat is produced by a monopolar high frequency current of the Oudin type, the

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* Prepared for the Special Study Course in Cancer under the auspices of the Philadelphia County Medical Society, May 22–24, 1928.

current being conducted to the lesions by means of a steel needle or other pointed metallic applicator. A single spark gap is usually employed in the circuit, although a multiple gap that is subject to refined regulation may be used.

The desiccation effect, as originally described by me, was produced by a high tension static current, transformed into a high frequency current of suitable quality by means of Leyden jars of proper capacity and a resonator supplying the correct inductance. Since the advent of the modern transformer type of high frequency machine, it has been shown that desiccation can be satisfactorily produced with the latter apparatus.

There is an impression among many of the profession that the desiccation and coagulation methods are one and the same. This is an error, since the effects produced on the tissues are quite different and can be readily demonstrated, both clinically and histologically. The Oudin current, by which desiccation is produced, is of relatively high voltage and low amperage, whereas the d'Arsonval current, by which coagulation is produced, is of lower voltage and higher amperage.

A milliampere meter cannot be used to measure accurately a monopolar current. The proper current strength necessary to destroy growths of different types and sizes within the mouth or elsewhere can be learned only by experience. The desiccation effect may be produced in the tissues by delivering the current through a short air space, by just touching the surface or by inserting a needle more or less deeply, according to the degree of destruction desired.

The desiccation method is used advantageously when the lesion is comparatively superficial and localized, and when it is desired to avoid a contracted cicatrix. It is subject to such perfect control that an exceedingly small growth, even on the cornea of the eye, can be successfully treated without impairment of vision by the subsequent formation of scar tissue.

A small growth on the vocal cords may likewise be destroyed without impairing the voice. It will thus be seen that this method can be employed advantageously in the treatment of such lesions in the mouth as leukoplakia, papilloma, angioma, Vincent's or other localized infections, lupus vulgaris, infected tonsils, exostoses, epulis, sarcoma, localized epithelioma, etc. The comparatively slight trauma to the tissues and the mild secondary inflammation explain, from a histologic standpoint, the slight scarring and the success obtained in treating delicate structures.

The Coagulation Method. Coagulation is produced by a bipolar high frequency current of the d'Arsonval type, a multiple spark gap being employed. It is more penetrating and intense than the desiccation method, and in accessible locations is utilized to destroy larger growths, even those involving bone.

There are many variations of technique in the application of this method to suit the requirements of the individual case. These cannot very well be described, but must be learned from practical experience. The active electrode should always be pointed. Steel sewing needles of various lengths may be employed. If still greater length is desired, metallic knitting needles or stiff wire cut to any length may be used, either straight or curved, so as to be adapted to particular anatomic locations. Since the effect of high frequency currents is, or at least as far as can be ascertained, entirely thermic, and not electrolytic, it does not matter, for practical purposes, what particular metal is used. As it is impossible to insulate these electrodes thoroughly, care must be taken that only such tissues as are undergoing treatment shall be touched. The indifferent electrode that is necessary in this method may be of any material that will conduct electricity, such as a bare metallic plate, or, preferably, a moistened asbestos pad covered with a metallic plate or wire mesh and bound together with heavy cloth, such as linen or duck. This should be placed in

close contact with the skin of the patient's back. Both the active and the indifferent electrodes are connected by insulated wires to either side of the d'Arsonval winding of the high frequency machine. Good contact in all the circuit connections is of great importance. A meter should be connected in this circuit as a guide to the current strength employed, which varies from about 200 to 2500 ma., according to the size of the growth to be treated. The meter is not an infallible guide in estimating the action of the current, since the reading is also influenced by the size of the patient under treatment, or, in other words, by the amount of resistance in the circuit.

Doyen's method of coagulation consisted in the use of a blunt metallic electrode applied directly on the growth, and another of the same or larger size at some point near the growth. It has been shown that the control by this technique is imperfect, and experience has taught me that the pointed active and the large passive electrode offer a superior method of application. While the current is passing, the needles may either touch the surface of the growth or be inserted into it, this depending on the depth of destruction desired. In pedunculated growths, a metal snare may be used to advantage as the active electrode.

As already stated, the d'Arsonval current, by which coagulation is produced, is of relatively low voltage and high amperage. If a short air space intervenes between the growth and the needle, the current will be conducted to the tissue in the form of convective sparks, which sometimes approach the intensity of a flame, this depending on the frequency of the oscillations of the circuit. Under such conditions the coagulation will be superficial. On the other hand, if the active electrode remains in close contact with the growth, heat will be generated in the tissues without the production of sparks. Under these conditions the tissues will be deeply coagulated, the actual depth depending on the duration of the application. Better control of coagulation can be acquired by inserting the needle applicator into the tissues to the desired depth, and thus shortening the treatment period.

Unlike the heat generated by these high frequency currents, which penetrates deeply into the tissues, that produced by the actual cautery is comparatively superficial in action. The former is generated within the tissues by their resistance to the current, while the latter is merely transmitted by contact. Whether the desiccation or coagulation method is employed, the aim should be to destroy the growth at a single operation.

In lesions of the body surface, the devitalized tissues should, as a rule, be removed immediately, either by excision or curettage, which usually may be accomplished without hemorrhage. If necessary, the base may then receive further treatment. Excision or curettage following electrothermic treatment is practiced less frequently in lesions within the mouth than upon the skin surface, owing to the greater danger of secondary hemorrhage because of maceration of the tissues by secretions and also by bacterial invasion. Therefore, with certain exceptions, the destroyed tissue is allowed to separate slowly. Bone that has been treated will sequestrate in about six weeks if a current of proper intensity has been employed.

Electrothermic Methods and Irradiation. In dealing with localized benign or malignant lesions, the superiority of the electrothermic methods over irradiation is shown by definite histologic changes and by comparison of permanent clinical results. With electrothermic methods, only diseased tissue is destroyed, the vitality of the surrounding normal structures being conserved. Subsequent treatments, should they be necessary, offer as good prospects of success as though the tissue had not received previous treatment.

On the other hand, with irradiation of such intensity to influence a malignant growth, it is impossible not to lower the

NOTE. A display of photographs before and after treatment has always been distasteful to me, and would be avoided if the message could be otherwise conveyed. Therefore, against my own personal inclination, such illustrations are submitted at the request of the editor. A vast number of photographs are in my files demonstrating that the results shown are not exceptional. The diagnosis in each instance has been confirmed by laboratory findings, it being the practice to biopsy every case admitted to my hospital.

It is regretted that sufficient space could not be allotted to include photomicrographs of sections of the cases illustrated, and also statistical studies. These will, however, be included together with a broad presentation of original work concerning cancer and its treatment, in my book now in preparation.

Acknowledgment and thanks are given for assistance in preparing histological data to Dr. Victor A. Neujean, pathologist to the Clark Hospital.

PLATE I

FIG. 1. Basal cell epithelioma after desiccation. Cells appear as long drawn-out slender threads, whole presenting a mummified appearance.
FIG. 2. Squamous cell epithelioma treated by coagulation, showing hyalinization and several sharply defined thrombosed vessels. Tumor cells have fused into a structureless homogeneous mass.
FIG. 3A. Squamous cell epithelioma, grade 3, of lower lip and buccal surface.
FIG. 3B. Result of one coagulation operation and radium treatment to cervical lymph nodes.
FIG. 4A. Angiofibroma of upper lip.
FIG. 4B. Result of one desiccation treatment under local anesthesia. Note absence of contracted scar.
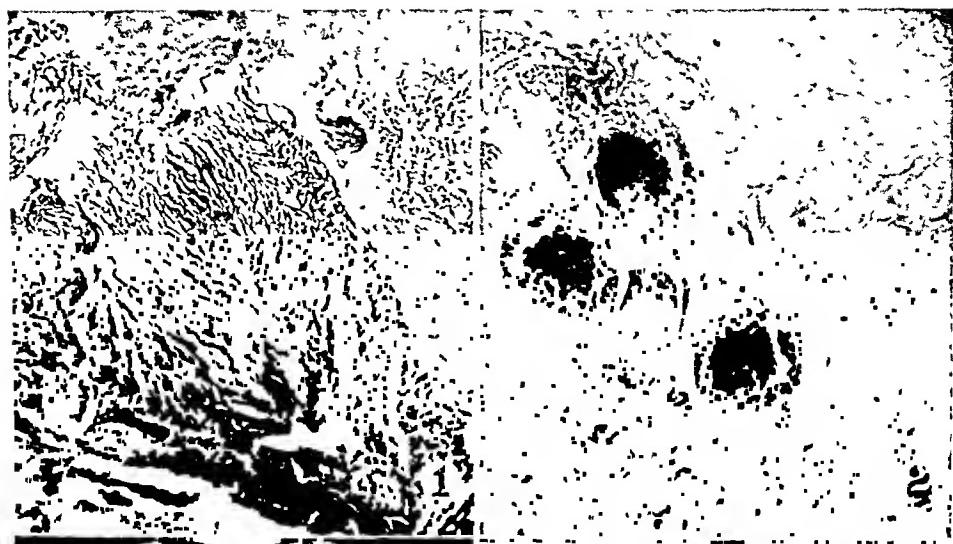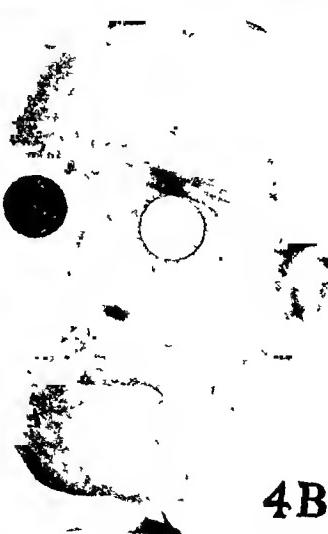
PLATE I

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PLATE II

Fig. 5A. Basal cell epithelioma involving upper lip, antrum, septum, nose, alveolus and hard palate. Three years' duration.

Fig. 5B. Result of one coagulation treatment. No recurrence in twelve years. Photograph taken ten years after operation.

Fig. 5C. Features reconstructed by sculpture method and attached to spectacle frames.

Fig. 6A. Squamous cell epithelioma, grade 4, of floor of mouth.

Fig. 6B. Result of one desiccation treatment and radium to cervical lymph nodes. No recurrence in five years.

Fig. 7A. Squamous cell epithelioma, grade 4, involving cheek through to buccal surface.

Fig. 7B. Result of one coagulation treatment and radium to neck. No recurrence in three years. Plastic operation to close opening is contemplated.

Fig. 8A. Extensive squamous cell epithelioma, grade 2, of tongue and floor of mouth.

Fig. 8B. Appearance after amputation by coagulation, and radium treatment to lymphatic drainage areas in neck. Soft pliable cicatrix. Patient later died of cervical metastasis, without local recurrence.

Fig. 8C. Showing artificial tongue made of moist cotton, materially improving speech.

PLATE II

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PLATE III

FIG. 9A. Extensive squamous cell epithelioma, grade 3, involving hard palate, alveolus, antrum, floor of orbit, and buccal surface.

FIG. 9B. Incision necessary to throw back flap to expose diseased tissue and bone. Healed by first intention with only slight scar.

FIG. 9C. Opening in antrum with mouth open. No recurrence in five years.

FIG. 9D. Type of denture that may be employed to close opening into maxillary sinus, preventing food and air from entering, thus promoting comfort and insuring normal speech.

FIG. 10A. Advanced basal cell epithelioma involving cheek, parotid gland and osseous structures. Had resisted many forms of treatment.

FIG. 10B. Result of one coagulation treatment under ether anesthesia. No recurrence in twelve years.

FIG. 11A. Mixed cell sarcoma of cheek and lower jaw, extending through into mouth.

FIG. 11B. Result of combined radium needle, desiccation, and operative surgery. Localized broken-down area was treated at angle of jaw, which does not show in photograph, and diseased bone removed with rongeur forceps. No recurrence in seven years.

FIG. 12A. Squamous cell epithelioma, grade 2, of nose, upper lip and septum.

FIG. 12B. Result of one desiccation treatment under local anesthesia.

FIG. 12C. Artificial nose attached to spectacle frames.

9A　　　9B　　　9C　　　9D

10　　　10B　　　11A　　　11B

12A　　　12B　　　12C

PLATE III

PLATE IV

FIG. 13A. Small round cell sarcoma with melanotic tendency, of bulbar conjunctiva and cornea. Recurred twice after two surgical excisions.

FIG. 13B. Result of one desiccation treatment under local anesthesia. There is no perceptible scar and no impairment of vision. No recurrence in seven years. (The desiccation method acts well in many types of corneal and conjunctival growths if involvement is not too deep.)

FIG. 14A. Basal cell epithelioma of upper and lower eyelid and of conjunctiva.

FIG. 14B. Result of desiccation under local anesthesia. Note absence of contracted scar, which is characteristic of results following desiccation if properly performed.

FIG. 15A. Small round cell sarcoma involving tissues of forehead, frontal bone extending through into frontal sinus, and upper and lower eyelids of both eyes. Radium only method that could give any hope of relief in this type of case.

FIG. 15B. Result of radium needle treatment. Patient lived for three and one-half years and finally died from extension of disease to brain.

FIG. 16A. Cavernous angioma of scalp, both upper and lower eyelid, and nose. Voluntary opening of eye was impossible. This is a type in which radium treatment is best. Lesion was considerably worse than appears in photograph.

FIG. 16B. Result of radium treatment. Note that angioma is flattened to skin level and that eye is open. Result much better than appears in photograph. (Small angiomas not involving important structures may be treated by desiccation with good cosmetic results.)

FIG. 17A. Mixed cell sarcoma, springing from ethmoid, filling orbit and causing great bulging of eyeball.

FIG. 17B. Result of combined coagulation and radium treatment. No recurrence in seven years. (Coagulation is an excellent method for exenterating orbit.)

FIG. 18A. Squamous cell epithelioma, grade 3, of orbit, ethmoid, and frontal and maxillary sinuses. (These advanced cases are still frequently seen, regardless of campaign of education for early recognition now carried on.)

FIG. 18B. Result of one desiccation operation. No such result could be obtained with any other form of treatment. Patient died of complications about a year afterward but not of the disease. Artificial features by sculpture method could easily be accomplished in this type of case.

13A   13B   14A   14B
15A   15B   16A   16B
17A   17B   18A   18B

Plate iv

PLATE V

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vitality of the surrounding normal tissue to a certain extent. In case of recurrence, little more can be hoped for from further irradiation, owing to the resulting fibrous changes. This is a fact well known to radiologists. Because of these resulting changes, irradiation should not be used routinely in conjunction with electrothermic methods in *distinctly localized benign or malignant lesions* within the mouth, except in very malignant squamous cell lesions, when it should be considered to take care of possible outlying malignant cells, since there is greater likelihood of recurrence in this type of lesion. Recurrences, however, are not always due to incomplete work, but to new lesions developing in favorable soil.

There are many cases in which the electrothermic methods are not applicable, and in which irradiation is preferable, but my experience has been such that I feel very strongly that the electrothermic methods alone with the exceptions noted should be used in the type of lesion mentioned, namely, primary localized lesions.

Electrothermic methods are strongly contraindicated in extensive lesions that cannot all be destroyed with one operation. If any of the disease is left, it will usually be stimulated to greater activity. If vital structures are involved, irradiation is preferred to electrothermic methods.

It is quite necessary to treat the lymphatic drainage areas in the neck by radium, roentgen ray, or, in some instances, a combination of both, to inhibit or destroy malignant cells migrating to the glands, or to destroy the pathologic element, if metastasis is already apparent.

Apparatus and Operator. High frequency machines, as devised by different manufacturers, vary greatly in construction; hence, there is a corresponding variation in the quality of the currents produced. The thermic intensity is often too great or too little, and an undesirable faradic effect, producing shock and contraction of the tissues, is to be expected when the improperly constructed machines are used. This lack of standardization is unfortunate, since to produce the desiccation effect under the best conditions, an accurate balance must be maintained between voltage and amperage, and also between capacity, inductance and resistance. Thus, different operators, employing various types of apparatus, may obtain different results.

A machine giving a satisfactory therapeutic current may not be suitable for surgical work. I have found it necessary to have machines constructed according to definite specifications in order to obtain the various features necessary for my particular requirements. Even with a machine constructed on correct lines, there is difficulty of application, principally in the acquirement of a proper technique.

Much harm can be done by an operator without practical knowledge of the various factors involved. This warning seems appropriate since a considerable number of cases have come under my observation that were improperly treated with high frequency currents.

Electrothermic methods can be best practiced only by those who have had surgical training and experience. They are quite as surgical in practical application as operative surgery, requiring the same knowledge of anatomic landmarks and the same surgical judgment that every good operator must have.

Indications. Electrothermic methods are peculiarly adapted to treatment of localized malignant growths occurring in any part of the oral cavity and adjacent parts, such as the lip, jaw, nose, throat, sinuses, eye, orbit, parotid gland, ear, etc. The efficiency of these methods is, in certain cases, increased by the combination of operative surgery, radium and roentgen rays.

Electrothermic methods should be used alone only in localized tumors of a type that does not tend to metastasize. The basal cell type of epithelioma occurring on cutaneous surfaces, such as the face and eyelids, even though extensive and with involvement of bone, may be so effectively treated by the desiccation or the coagulation method that recurrences are infrequent.

In localized squamous cell epitheliomas on cutaneous surfaces or mucuous membranes, the results are almost as good as in the basal cell type, depending to a great extent upon the grade, or in other words, upon the degree of differentiation of the cells, from the embryonic to the adult cell. *When the growth is no longer localized and metastasis has occurred, it is again emphasized that other methods must be used in addition.* The choice between local or general anesthesia is governed by the same principles as in operative surgery.

Technique. There are many variations in technique to meet different indications, but as an example of standardized technique, the operation of amputation of the tongue by the coagulation method is here described.

AMPUTATION OF THE TONGUE

If the case is far advanced, with considerable general emaciation, it is my practice to perform a preliminary gastrostomy. This also applies to extensive lesions, located anywhere in the mouth or throat, that render deglutition difficult. The operation of gastrostomy may be performed under local anesthesia, with little hazard or inconvenience to the patient. This procedure has several advantages in permitting the building up of the patient's strength, relieving the pain incident to swallowing, and frequently resulting in a considerable reduction of swelling and induration in the tongue and throat following the rest given to these parts.

The tongue can be coagulated readily through its base and then excised, with infrequent secondary hemorrhage; but to obviate this danger completely, it is considered safer to ligate the lingual arteries as a preliminary measure, or for still greater safety, one or both of the external carotid arteries.

Ether anesthesia is employed by preference. The ether should be removed from the room when the patient is fully under its influence and before the current *is* applied, else it might ignite. Should the operation be unusually prolonged and the patient show signs of regaining consciousness, the operation may be temporarily discontinued as often as required and ether again administered. Ordinarily this operation is of such short duration that the use of ether a second time is not necessary. Scopolamine, 0.01 grain (0.6 mg.) and morphine, ¼ grain (16 mg.) may, in some instances, be used hypodermically one hour before the administration of ether. Less ether will be necessary under such conditions, and the immediate postoperative discomfort will be minimized.

After the jaws have been separated with a mouth gag, a heavy silk suture is passed from side to side through the tip of the tongue, by means of which it is drawn well forward. The coagulation needle is then brought in contact with the anterior surface of the tongue as far back as is necessary, even to the level of the epiglottis, and the current is turned on, either by the operator by means of a foot control, or by an assistant on signal. The needle is then moved across the tongue and carefully inserted into it at different points, coagulation being allowed to take place as it moves. After this has been thoroughly accomplished, the tip of the tongue is elevated by means of the suture, and a straight, sharp sewing needle, of proper length, is substituted for the curved knitting needle previously used. The frenum is then coagulated, and the needle inserted between the tongue and the floor of the mouth. When coagulation is again completed, curved scissors may be used to cut through the coagulated areas on both surfaces, and the tongue is then separated from its attachments.

The after-treatment consists of the use of a simple antiseptic mouth wash, the application two or three times daily of a weak solution of sodium hypochlorite, which sterilizes, or at least minimizes bacterial invasion, deodorizes and tends to keep the slough firm and free from maceration.

Care should be taken not to remove the slough prematurely, else secondary hemorrhage may occur. Usually organization

takes place in the vessels before the time for the separation of the slough.

When a preliminary ligation of the linguals or carotids has been performed, hemorrhage is, of course, not so much to be feared.

Such a major electrothermic operation should be performed in a well-appointed operating room, the same preparatory technique being used as in any surgical operation, although perfect sterilization is obviously not so important as in a cutting operation.

OTHER ADVANTAGES AND INDICATIONS

In addition to the desiccation or coagulation of the affected tissues and the sealing of blood and lymph channels, the heat penetrates beyond the area actually destroyed and devitalizes malignant cells, without permanently impairing the healthy tissue, thus lessening the likelihood of local recurrence or metastasis and conserving the maximum amount of normal tissue. The relief from pain and comparative freedom from postoperative discomfort are worthy of note. This is probably explained by the destruction of the sensitive nerve endings.

The desiccation and coagulation methods are certainly superior for general use to the so-called "radio knife," or high frequency cutting current, the heat from which does not penetrate the tissues far beyond the point of contact. The latter method has, however, a definite field of usefulness, but this will not be discussed here.

Malignant cells, especially those that are least differentiated, are more vulnerable to heat and are devitalized at a lower degree of heat than are normal cells. The thermic sensitiveness to the action of the high frequency current has often been observed clinically and demonstrated histologically.

The practice of intentionally treating a malignant lesion by a series of desiccation or coagulation operations is reprehensible and must be discouraged, unless, through error in judgment or for some other reason, an incomplete operation is performed the first

time, and a second becomes necessary to complete the work. It is quite as irrational to do this intentionally as to expect success by excising a cancerous growth surgically in a series of operations. Therefore, it should be the aim to complete the work with one operation if possible.

Desiccation is a most satisfactory method of treatment of infected tonsils, especially in adults, if the operation is correctly performed. If the technique is not good, poor results will be obtained. This method has been disapproved by some operators, but examination of their technique has revealed the cause of their failure. If properly done, the method will bear the most critical examination. This statement is made after thoughtful consideration of facts, based upon twenty years of observation and experience with the desiccation method in tonsil work.

Neoplasms of the oral cavity possess, in general, the same characteristics and manifest the same behavior as tumors arising elsewhere. The relative degree of their benign or malignant nature is influenced to a considerable extent by the anatomic and functional properties of the structures involved. For a better interpretation of the nature of neoplasms in general, and those of the oral cavity in particular, one must take into account not only the clinical and histologic data, but also the biologic elements concerned in the development and growth of the tumor.

HISTOLOGIC CONSIDERATIONS

Our knowledge of neoplasms is meager at best. What little knowledge we have is frequently thrown into confusion because of our failure to visualize the problem as a whole, and to link the clinical and histologic evidences with the biologic factors. From the clinical aspect, the line of demarcation between benign and malignant tumors appears well defined and rests upon the basis of special characterization common to both. Viewed biologically, the line of demarcation, while still evident, becomes less distinct. To the histologist, all neoplasms represent a func-

tionless mass of proliferated cells. From the biologic point of view, all neoplasms are malignant in that they are parasites and live at the expense of the host. Thus, the border line between benign and malignant neoplasms becomes more distinct, or less distinct, or entirely obscured, according to the particular point of view of the observer.

Clinically, we look upon malignant disease as distinct and apart from all other diseases. Histologically, neoplasms possess certain things in common, resembling acute and chronic inflammatory tumors, in that they represent an aggregation of proliferated cells, but differing in the type of cell composing the tumor: the polymorphonuclear in acute inflammatory tumors, the lymphocyte, or fibroblast, in the subacute or chronic inflammatory tumors. Biologically interpreted, neoplasms are found to have a property possessed by other diseases, which is based upon an inherent attribute common to all living cells, namely, reaction to irritation. The manifestation of this reaction is cell proliferation and multiplication. Whether the proliferated element is a polymorphonuclear, fibroblastic, endothelial, or neoplastic cell is, in great measure, determined by the type and intensity of the irritant.

The cause of neoplasms, whatever it may be, appears to be activated by a common factor, chronic irritation. In no other part of the body can one trace such close relationship between persistent irritation and development of malignant growths as in the oral cavity. The mouth and its structural contents, because of their peculiar anatomy and function, are frequently subject to minor trauma. A jagged tooth, ill-fitting denture, loose bridges, irritating material, such as tobacco, etc., act as irritants and are apt to initiate a chronic inflammatory process. The inflammatory reaction persists because healing is prevented by several agencies present in this particular location, such as the frequent passage of food, the general motility of tongue and buccal surfaces, and the presence of bacteria whose activities are enhanced by the already devitalized area and the moisture and temperature of the mouth. A vicious circle is thus established.

To exemplify: A chronic inflammation of the tongue is induced by any of the above-mentioned irritants, resulting in a chronic glossitis. The inflammation persists not only because of the particular irritant giving rise to it, but also because of the location of the lesion in this particular structural and functional environment. A chronic glossitis is established, with the formation of fissures in the inflamed area that refuse to heal. The surface epithelium in the affected zone eventually responds to this persistent irritation in the form of proliferation and multiplication of its cells, leading to an overgrowth of the surface epithelium, manifested clinically as raised white patches (leukoplakia). With the continuation of this vicious circle, the hyperplastic epithelium sooner or later assumes greater activities and the simple overgrowth of the surface epithelium advances. Thus, leukoplakia may be looked upon as the precursor of lingual carcinoma.

Again, carious teeth frequently lead to multiplication of the paradental epithelium. The hyperplastic cells, like those of the surface epithelium of the tongue, may eventually assume neoplastic activities, giving rise to an adamantinoma of the maxilla.

As stated above, the behavior of benign and malignant tumors is influenced by the anatomy and function of the structures involved. This applies particularly to the mouth. Thus, a papilloma of the tongue, buccal surface, etc., is more likely to undergo malignant changes than papilloma elsewhere. Carcinoma of the tongue, buccal surface, alveolus or floor of the mouth is, as a rule, very destructive and metastasis is more rapid and earlier than in other locations. The tongue is supplied by a double lymphatic system, one branch draining the submucosa and the other the muscularis. These practically envelop the whole organ from base to tip, and after pursuing an irregular course, send their tributaries to the submental, submaxillary

and deep and superficial cervical lymph nodes. The lower deep cervical lymph nodes are located on the jugular vein, the upper deep cervical near the common carotid just above the point of bifurcation. The rich lymphatic network, therefore, offers many avenues for the travel of the various cancer cells to the neighboring lymph nodes. The location of the lymph nodes and their relation to vital structures influence, in a great measure, the clinical course of malignant disease of the mouth.

While squamous cell carcinoma is the growth most frequently encountered, one not infrequently meets with other types in the oral cavity, such as sarcoma, adamantinoma, epulis, papilloma, hemangioma and lymphangioma. Epulis, adamantinoma and papilloma, though classed with benign tumors, may assume active growth and pursue a malignant course.

The grading of tumors gives some indication as to prognosis and has an influence on the choice of treatment. Statistics relative to results obtained by various methods, unless based upon grading according to the degree of cell differentiation, are of comparatively little value. Therefore statistics based upon a general diagnosis, such as "malignant" or "squamous cell epithelioma," are misleading.

Since the actual etiologic factor regarding cancer is still unknown, no specific having yet been discovered, we must use such methods as have proved to be of value in combating this disease. They include, as stated before, operative surgery, the roentgen ray, radium and electrothermic methods (desiccation and coagulation). While surgery plays an important rôle, its usefulness has, in many cases, been enhanced by the employment of roentgen rays or radium as preoperative and postoperative adjuncts. In certain instances, roentgen rays and radium, either singly or in conjunction, have entirely replaced operative surgery. Like surgery, desiccation and coagulation remove the tumor growth, but, unlike surgery, they do not act as a mere physical agent removing the growth *en masse*, but destroy the neoplas-

tic cells in situ to some depth beyond the growth.

In the removal of a neoplasm, while the chief object is the destruction of the malignant cells, a secondary important factor is the maintenance and preservation of the vitality of the adjoining healthy tissue, and that is influenced, in a large measure, if not altogether, by the associated degeneration and fibrosis. The observation that the resulting scar in the case of electrodesiccation and coagulation is soft and not so extensive as that resulting from the use of some other methods may not only be confirmed clinically but also explained histologically.

The electrothermic methods are governed by certain fundamental principles. They are dependent for their results on the resistance of the tissue to the current, which manifests itself in the formation of heat. The high frequency current used in desiccation is of a relatively low amperage, producing only a moderate degree of heat, but of sufficient intensity to cause complete evaporation of the fluid content of the cell. The coagulation current is, on the other hand, of comparatively high amperage and low voltage, and induces such intense heat that the cells are not only dehydrated but their protoplasm is coagulated as well.

Histologic Studies Concerning Electrodesiccation and Electrocoagulation. The microscopic picture of neoplastic tissue submitted to desiccation presents typical characteristics. While the cells still retain their outline, they appear shrunken, elongated and dried up. Evidence of such degenerative changes as hydropic or fatty degeneration are not discernible. The blood vessels in the immediate and adjacent vicinity of the field` of operation are thrombosed.

In tissues subjected to coagulation, there is complete loss of cell outline. The neoplastic cell elements seem to have fused into a structureless, homogeneous mass, a hyalinized appearance resulting. The blood vessels and lymph channels are thrombosed. The secondary and associated

changes in all such lesions are degeneration and fibrosis. Whether the fibrous connective tissue shall be abundant and dense, or less abundant and soft, is influenced by the amount and nature of the accompanying degenerative and necrotic material, which, in turn, are determined by the particular type of irritant. Thus, after desiccation, the fibrosis is slight and the resulting scar is soft and pliable. Following coagulation, the fibrosis will be more or less abundant, this depending on the intensity of the heat generated and the consequent degree of frame destruction. The size of the subsequent slough or sequestrum, where bone is involved, is, therefore, largely under the control of the operator. (See Figs. 1 and 2). (From the Clark Hospital Laboratory.)

SUMMARY AND FINAL REMARKS

Twenty years of intensive study and experience have demonstrated to me that malignant disease within the mouth and adjacent parts, while always a most serious affection, is not necessarily hopeless, since many brilliant results are obtained by the judicious employment of combined methods, of which electrodesiccation and electrocoagulation are most important, indeed, are, on pure merit, entitled to hold first place in treatment of primary lesions.

Operative surgery is also considered indispensable, and is constantly employed by me to ligate blood vessels and to resect bone. In certain instances cervical lymph nodes are surgically resected, but never before the malignant element has been inhibited, or, when possible, entirely destroyed by pre-operative irradiation treatment. A gastrostomy is often performed to insure proper feeding in undernourished patients, owing to difficulty in deglutition before the operation and during the convalescent period. Many radical electrothermic operations have been rendered possible by this preliminary gastrostomy. Operative surgery has a still greater field of usefulness in cancer involving other parts of the body, which will be discussed in another paper.

Radium and roentgen rays are used in my practice in connection with neoplasms in the locations under consideration principally to control metastasis to the cervical lymph nodes, and their value for this purpose has been definitely established.

The primary lesions are, with certain exceptions (cases in which vital structures or those very important to conserve are involved) best treated by the electrothermic methods, and I have had no cause to regret this practice after critical comparison of results of different methods in many cases.

The histology of malignant lesions within the mouth and elsewhere is often a determining factor in prognosis, and also a guide to treatment, since embryonic, fully differentiated and intermediate cells require different treatment, especially in relation to irradiation; for example, squamous cell epithelioma, grade 4, which cells are undifferentiated, though most malignant, respond more readily to the roentgen ray and radium treatment than grades 3, 2, or 1, which are in different stages of differentiation. This is explained by the slight resistance to these treatments by the embryonic cells and the greater resistance as the cells approach the adult grade. Many pathologists do not yet appreciate the significance of this differentiation, nor do they recognize the different grades under the microscope. A check of many cases in which histologic studies have been made during the past twenty years has demonstrated to me beyond a doubt that it is important to know definitely the grade of the tumor and that there are certain characteristics of staining that positively identify the grades.

Finally, permit me to state with assurance that electrodesiccation and electrocoagulation employed in their proper place are the most important measures for the successful treatment of primary neoplastic and allied lesions in the mouth and adjacent parts, though operative surgery, roentgen ray and radium are also valuable as described, in their respective rôles, each complementing the other.

THE BALDWIN OPERATION FOR APLASIA OF VAGINA*

WITH REPORT OF ONE CASE

C. Jeff Miller, m.d., f.a.c.s.

NEW ORLEANS

THE mechanism of vaginal aplasia is quite clear, even though its etiology is not yet understood, beyond the fact that, like all developmental errors, it is due to some arrest or perversion of growth caused by disturbed nutritional balance or by actual disease in either the mother or the fetus. The tubes, the uterus and the vagina, it will be recalled, arise from Müller's ducts. These ducts, which at first extend as separate, solid, unfused structures to the urogenital sinus, by the ninth week of intrauterine life become merged in the lower half into one structure, and by the end of the fifth month are completely differentiated into tubes, uterus and vagina. Errors in fusion of the lower part of this embryonic structure give rise to anatomic defects in the organs which develop from it, and, because of the sameness of origin, defects of the vagina are frequently associated with defects of the uterus and tubes also.

The ovaries, on the other hand, usually do not share in the anomaly. They arise from different embryonic tissue, the Wolffian bodies, and, since they determine the sex of the organism, defects in their development give rise to the condition known as hermaphroditism or bisexualism. A woman who exhibits an absence of the vagina usually has well developed feminine characteristics because her ovaries are usually not involved in the malformation. She possesses a female psyche but her normal female functions of menstruation, coition and child-bearing cannot be performed because a part of the essential mechanism is lacking, and the expression of her sex, if we may so term it, is forever denied to her.

For more than a century efforts have been made to aid this unfortunate group of women by surgical means. The first attempts were little more than the creation of an opening in the cellular tissue of the rectovesical space, the canal being maintained by the wearing of some form of tampon or plug. When this method failed, as was to be expected, the newly created passage was lined with transplants, chiefly from the thighs or the vulva, or, as in the Graves operation, from both. The most recent modification of this type of operation is that devised by Frank and Geist, which is an adaptation of the Gillies tube-flap method of facial surgery. The flap is taken, as usual, from the thigh, but the operation is performed in stages, to secure perfect vascularization of the transplant, and the canal is eventually lined with a graft whose nutrition is assured.

Successes have been reported with each of these methods, but it cannot be expected, because of the structure of the lining tissues, that the results should be uniform or even permanent. It has been repeatedly pointed out, in this connection as in others, that while mucous membrane makes a very fair substitute for skin, the converse of the proposition is by no means true. Any skin transplant to the vaginal canal has a tendency towards contraction and atrophy, and for that reason this canal, which is essentially a collapsible tube whose walls are in contact the greater part of the time, must be lined with mucous membrane, whose tendencies are diametrically opposite.

Mackenrodt achieved this result by lining the surface of his newly made vaginal canal with mucous membrane

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taken from another patient operated upon at the same clinic and at the same time, but his performance is little more than a tour de force. Such a source of supply is obviously limited, quite aside from the other very apparent disadvantages of the procedure.

The two most practical methods yet suggested are those of Schubert (really Popov) and of Baldwin, each of which utilizes some portion of the intestinal canal for the formation of the new vagina. Schubert contends that the proximity and anatomic structure of the rectum, which is that of a deferent organ, make it peculiarly suitable for the new purposes to which it is to be put. The lower four inches are utilized, and a sort of blind cul-de-sac is created, which is attached as high as possible to the sacrospinal ligament; removal of the coccyx is a necessary preliminary. The immediate danger to life is supposed to be relatively small. Schubert himself reported 95 collected cases with a mortality of 3.2 per cent, although Judin, I believe more correctly, quotes a mortality of 10.3 per cent in 68 cases collected by Rabinowitch and brought up to date by himself. How many of Schubert's cases, if any, are included in this group I cannot say. The operation is certainly technically very difficult, and the end results, in spite of functional successes, are not always happy, for fistulae are quite frequent and actual incontinence of feces is not unusual.

Baldwin in 1904 suggested the utilization of a section of the ileum, having devised the technique for a patient who had consulted him for a complete acquired atresia, the result of a sloughing of the entire vagina and cervix after craniotomy. The patient, however, refused the abdominal procedure and the author had no opportunity to try out the method until 1907. At that time it was employed with complete success in a similar case in which almost complete vaginal atresia had followed a difficult forceps delivery. Mori of Tokio performed the operation in 1908 and is frequently stated to have been the first to do it, but as Baldwin's case was reported in the *American Journal of Obstetrics* for November, 1907, there seems no question as to his priority both in suggestion and in performance.

The technique of the Baldwin operation is so well known that only the merest outline is necessary. Briefly, it consists of the following steps:

1. The formation of a vaginal canal by dissection of the rectovesical space to the level of the peritoneum.

2. Laparotomy, isolation of the most dependent loop of ileum, pursestringing of the four severed ends, lateral anastomosis of the main bowel.

3. Incision of the cul-de-sac and transplantation of the isolated loop of ileum (doubled) into the vaginal space by the aid of gentle traction from below.

4. Suture of the pursestringed ends of the isolated segment at the peritoneal level of the vaginal canal, followed by the usual abdominal closure.

5. Opening of the bowel from below, thorough cleansing, packing of each segment loosely with iodoform gauze, stitching of the circumference to the perineal opening.

6. Repeated postoperative packing at regular intervals, crushing of the bowel septum between clamps at the end of three weeks or longer, dilatation of the new vagina as indicated.

In spite of numerous suggestions, the author has never seen cause to modify his original technique. He has stated from the beginning that if the ileum, for anatomic reasons, cannot be employed the sigmoid colon may take its place. He insists that the doubled loop of bowel should be used, since a single section makes the vagina too small for practical purposes. He stresses the importance of careful dissection between the rectum and bladder, so as to avoid puncturing either organ, and it is easy to see that if the anatomy is at all confused it might be well to insert guiding instruments into both.

Before Baldwin published his technique

he observed many hundreds of patients at laparotomy, and in no single instance did he find that the amount of available slack in the ileum or the sigmoid flexure of the colon would have prevented the performance of the operation. My own experience in abdominal surgery leads me to believe that he is entirely correct in his assumptions, and for that reason I can see little point to the various modifications which have been proposed. Constantini, to mention a specific instance, has devised a technique whereby sectioning of the mesentery is avoided, a procedure which he considers adds materially to the dangers of gangrene. He places his clamps on the intestine in such a manner as not to include the mesentery, which, after the usual pursestringing of the ends and lateral anastomosis of the bowel, is rolled up intact behind the sutured section. His experience with this maneuver on 18 cadavers and 2 living patients leads him to believe that section of the mesentery is needless, since sufficient mobilization of the isolated coil can be secured without it. In most cases perhaps it can be, but it is easy to conceive that where one is dealing with a mesentery which is short, or fat, or both, this technique would result in dangerous tension on the sutured bowel, and so would defeat the very purpose for which the author devised it.

Baldwin has always emphasized the importance of preserving the mesenteric circulation, and I think Judin's technique is preferable to Constantini's. He points out that in choosing the loop to be isolated, whenever possible one should be selected whose mesentery contains feeding vessels which are small and which lead to the free edges. After suture to the vulval opening, these free edges undergo less strain than does the middle portion of the mesentery, and the circulation is less impaired than it would be if the large nutritive vessels were located in the center.

The operation is not always free from technical difficulties. In one of Baldwin's own cases, for instance, previous attempts to establish a vagina had resulted in so much scar tissue below that the rectovesical dissection was extremely difficult, while in the same case either the previous removal of both ovaries (for excessive symptoms of the molimen) or an inflammation of the appendix had resulted in so many adhesions that the situation above was equally complicated. Moreover, like every other abdominal operation, this one has its sequelae. The narrowed lumen of the bowel and the development of postoperative adhesions make intestinal obstruction always a possibility in the future, and cases have been reported in which it actually occurred. Baldwin describes a case, not one of his own series, in which, at the end of an apparently perfect convalescence, the transplanted bowel suddenly appeared on the dressings, either because the mesenteric circulation was defective in the loop selected or because the blood supply was cut off by too snug a closure of the peritoneum about it. Somewhat similar is a case of Peterson's, in which, several years after an operation entirely successful except for an excessive secretion of mucus, the bowel prolapsed to such an extent that it had to be anchored to the infantile broad ligaments.

Postoperative vaginal pain has been observed in several cases, though I personally have not witnessed it. In one of Judin's own cases it was so extreme that during the giving of a douche the nozzle was firmly gripped by the wall of the new vagina, supposedly as the result of excessive intestinal peristalsis. One wonders whether, in this instance at least, some involvement of the muscles of the pelvic floor was not partially responsible.

One of the chief disadvantages of the Baldwin operation, and one which is said to be almost entirely lacking in the Schubert technique, is the excessive secretion from the bowel wall. Baldwin states that this occurs only when too long a loop has been used, but I cannot follow his argument; such a secretion is a normal function

of intestinal mucosa, and I cannot see how the length of the loop can influence it. Judin quotes Stoeckel to the effect that the discharge is more likely to be annoying when albugineous food is eaten than when fats are taken in quantity, but regulation of the diet in this regard is plainly impractical. One or two writers have suggested an explanation which may be correct, that the discharge in itself is really a rather slight affair, and is simply a source of annoyance to women who, because of their anatomic defects, have never before felt the sensation of any sort of vaginal discharge, menstrual or otherwise. I think it is generally agreed that if the discharge is present, it tends to decrease in time.

Judin and Daniel both advocate the use of spinal anesthesia on the ground of the excessive length of the operation, which they set at two hours or more. Unless unforeseen obstacles are present I cannot see why it should last so long. In one of my own cases the procedure lasted just over an hour, and in the other it took only forty minutes.

These points, however, are minor considerations. The chief consideration is that this is unquestionably an operation which endangers life. It is true that in contrast to the usual intestinal operation, which is undertaken for grave pathology, this is undertaken, presumably, on persons in excellent condition. It is likewise true that careful asepsis will for the most part eliminate infection, the most dreaded of all complications. But the matter cannot be dismissed so lightly. Even when performed with every circumstance favorable, intestinal surgery carries with it an inevitable mortality, which is variously set at from 2 to 10 per cent. The latter figure may be too high, but the former is certainly too low. Baldwin himself has done this operation twenty times with only one death, a mortality of 5 per cent, and he believes that this death would have been prevented had not the patient and her husband, both ignorant foreigners, refused to permit any postoperative treatment at all. So far as I

know, no attempt has been made to collect the American cases, but the mortality of Continental surgeons is quite high. Thus Daniel quotes 79 cases with a total mortality of 14, 17.5 per cent. Judin quotes 106 cases collected by Rabinowitch (whether or not Daniel's cases are included I cannot say) with a mortality of 15, 14.1 per cent. To these he adds 16 others, 6 of them done personally, with 2 additional deaths, giving a total mortality of 13.38 per cent.

Baldwin claims that this death rate is entirely unnecessary, and that when it does occur, it is due either to a departure from the original technique or to the performance of the operation by unskilled surgeons. I agree with him to a certain extent in both of these claims, but it must not be forgotten, as I have already pointed out, that any intestinal surgery presupposes an inevitable minimum mortality, and that all operations, regardless of their gravity, will at some time or other be performed by men who are not qualified to do them.

In spite of these objections, I think there is little doubt that the Baldwin technique is the operation of choice in those instances of absent vagina in which operation is indicated at all. The question, therefore, is when is operation indicated? From a purely surgical standpoint, absence of the vagina, whether congenital, or, as in Baldwin's first 2 cases, acquired, would seem a definite indication for the performance of some sort of surgery, but from the ethical side the decision is not so clear-cut. In both the Baldwin and the Schubert operation the results are, generally speaking, good, in that the artificial vagina acts quite satisfactorily as an organ of coition. That pregnancy and labor are also possible if the remainder of the sexual apparatus is intact is proved by the case reported by Wagner of Prague, in which during 3 deliveries a vagina constructed by the Schubert method stood the test of parturition. But in the average case the other sexual organs are either absent or underdeveloped, and, even granting that many women with a normal sexual apparatus

suffer from dyspareunia and that many others, equally fully equipped, never conceive, even granting this, the question arises whether we have the ethical and moral right to ask a woman to risk her life in order to gratify what, under the circumstances, can be nothing more than a purely physical desire.

Certainly there is no indication for operation in a young woman who does not contemplate marriage unless, as in Wright's case, the knowledge of the defect is exerting a deleterious nervous and mental effect. How much of the trouble was due, in this special instance, to an excess of ovarian activity it is not possible to say, but the good results of oophorectomy seem to prove that it played a large part. Operation is certainly indicated in such a case as that reported by Baldwin (the first in which he performed the operation) in which a normal, functioning uterus demanded some channel for the exit of the menstrual blood, and in which the alternative would have been hysterectomy. Probably operation is indicated in a young woman about to be married, or in a woman married without knowledge of her defect. Many such instances are reported in which the patient has threatened suicide if she were not aided, or in which a marriage would have been annulled and a home destroyed unless some intervention were done.

Even with this "social" indication granted, there is nothing to be said for the performance of the operation unless the patient is fully aware, and unless her husband, if he exists, is fully aware, of what it entails. If the risk is clearly understood, and if the woman's social circumstances are such that she is ready to assume it, then and then only is the conscientious surgeon justified in making the attempt to repair nature's error. In short, this is an operation which, despite its ingenuity, should never be undertaken "lightly or unadvisedly," but only when one is honestly convinced that the circumstances of the special case justify the dangers inherent in its performance.

The first case in which I used the Baldwin technique was reported in the *American Journal of Obstetrics and Gynecology* for September, 1924. The patient, then a young women of nineteen, was operated on at Charity Hospital in 1921, just prior to her marriage, and examination at repeated intervals since has shown a perfect and permanent result. Inspection through the ordinary bivalve speculum gives no hint that one is not viewing. a normal vagina, and her husband has no idea that she is in any way defective. In this instance both uterus and tubes were rudimentary, so that only vaginal function could be hoped for. The ovaries were about a sixth of their normal size and there was no evidence of corpus luteum formation, though an interesting feature of the history is that, as a girl of fourteen, for a period of several months this patient had attacks of severe abdominal pain associated with engorgement of the breasts, and, as she looks back on them, probably coincident with a normal menstrual cycle.

The case which I am now reporting presents several interesting features. I first saw the patient on May 23, 1928, several days after her marriage, the consultation being sought because marital relations had proved impossible. Local examination disclosed the labia majora poorly developed and the labia minora practically absent. The only evidence of a vagina was a small sinus in the perineal mass, which admitted a probe for perhaps half an inch. Rectal examination was unsatisfactory. Except for this local defect the patient showed no abnormalities of development.

She was at this time thirty-one years of age, and, although the daughter of a physician, she seems to have entered upon her marriage entirely unaware that the absence of menstruation throughout her life denoted any physical defect. Her early history was without incident except for a story of a left inguinal hernia since childhood, which, four years previous to this time, had enlarged to such an extent that

operation was necessary. Permission to investigate the previous record was secured, but, most unfortunately, details were entirely lacking. It was merely stated that left inguinal herniotomy had been done, and that the sac contained the left tube and ovary. There was no mention of their state of development, nor was there any mention of the vaginal defect or of the absence of menstruation.

On May 28, 1928, under ether anesthesia, a typical Baldwin operation was done without difficulty. At laparotomy the ovaries were found to be of normal size and considerably scarred, showing that the changes incident to ovulation were occurring, although the patient, when questioned later, denied any symptoms suggestive of the molimen. Behind the upper rectum, in the mesentery of the lower cecum, was a mass resembling a kidney in contour but rather larger. Whether this was the left kidney, which was missing, or the uterus, which also could not be located, it is not possible to say; my impression is that it was a kidney, but the investigation was not continued, since it would have served no useful purpose and would merely have prolonged the operation. The tubes were poorly developed and no ligaments were identified. The right urinary apparatus seemed entirely normal.

The patient's convalescence was most gratifying from the surgical standpoint, although it was complicated by a severe cystitis, probably due to the prolonged use of the catheter. Six weeks after operation the bowel septum was clipped, anesthesia being necessary because of the patient's absolute lack of cooperation when the procedure was attempted at the office. I have advised dilatation, which she has refused, but to date the functional result seems excellent, and the discharge is not profuse enough to be complained of even by such a frankly neurotic woman as this patient is.

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A SERIES OF 84 CASES FOLLOWING BILATERAL VASECTOMY FOR THE PREVENTION OF POSTOPERATIVE EPIDIDYMITIS*

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BROOKLYN

CAREFUL investigation of the records of the cases on the Urological Service of the Long Island College Hospital revealed the fact that the incidence of infection of the epididymis was 50 per cent, some of the cases having a bilateral involvement. There seems to be little difference whether the prostatectomy had been done in one or two stages, and it was decided that for a period of six months bilateral vasectomy would be performed on all cases as a prophylactic measure against epididymitis.

At the end of six months no epididymitis had occurred, but as a result of this surgical procedure, two infections resulted, one requiring an orchidectomy and the other necessitating the patient staying in the hospital a week longer due to the fact that the scrotal wound had to be opened and drained. At that time, for these occurred in our first 10 cases, we had not perfected our postoperative care of the scrotum. Now our only dressing is flexible collodion placed on the wound at the time of operation, care being taken that the sutures are buried under the collodion and not sticking through it, so as to act as a wick for infection. The wounds are not touched for five days, at which time the sutures are removed, and another collodion dressing applied. Under this regime no infections have resulted despite the drainage that passes over the scrotum in suprapubic wounds.

It was brought to the attention of the department that the Brady Urological Clinic in Baltimore was ligating the vasa with a through and through silk-worm gut suture, encircling the vas and including a small amount of scrotal skin, tied tightly and allowed to remain for ten days, in order to prevent postoperative epididymitis. This method reduced their incidence from 33 per cent to 4 per cent. In view of the above 2 cases of infection following vasotomy, it was decided to adopt this method of occluding the vasa. We ligated 6 cases in the above manner, and 3 of them or 50 per cent developed epididymitis ranging from seven days to twenty-one days postoperative, and the method was dropped. In 1 of these 3 cases, the epididymitis caused chronic pain for a period of seven months, and at the end of this time an epididymectomy was performed; serial slides taken above and below the site of the ligation showed the lumen to be reduced in caliber but not totally occluded.

On our service 84 cases of bilateral vasectomy have been examined to date and there has been no incidence of epididymitis. Two cases developed ˙ lateral swelling of the scrotal tissues the nιoι ιg following vasotomy, which disappeared in four and five days respectively. These cases were not epididymitis, for at all times the epididymis was easily outlined and was not enlarged or tender. Whether these edematous tumors were circulatory or physiological due to surgical trauma we are not prepared to say.

A certain investigator, who sectioned vasa of experimental rats to see if the Steinach theory was physiologically true, reported that the part of the vas between the site of sectioning and the epididymis became enlarged and lumpy, and on open-

ing proved to contain collections of live sperms. We have watched for this accumulation in our cases and have never noted it, probably on account of the age of our patients.

Analysis of these 84 cases shows that there were 65 prostatectomies for adenoma, 13 for vesical and prostatic carcinoma, 5 for vesical calculi and 1 for impassible stricture. All patients were over sixty years of age.

CONCLUSION

1. In our 84 cases of vasectomy there has been no incidence of epididymitis, but there were 2 cases of unexplained scrotal engorgement within twelve hours after operation which subsided within five days. We are led to believe that this was a circulatory phenomenon, as occasionally we encounter venous hemorrhage in this procedure, and we observed that the epididymis was at all times normal to palpation.

2. We do not regard the through and through ligation of the vas with silkworm gut as satisfactory a procedure in our hands as vasectomy.

3. The surgical after-care of the scrotal wounds is as important as the operation, and we have found that a collodion dressing properly applied has proved most satisfactory for this type of wound.

Such results lead us to advocate this procedure routinely as it adds six minutes only to the operative period. It can be done under local anesthesia in the ward dressing room. In theory the testicular harmones are increased by its use, and, most important, it prevents a complication that prolongs painful convalesence and occasionally may be dangerous.

DISCUSSION

Dr. McKenna. Dr. Rathbun and I began over a year ago to ligate the vasa through the skin as has been described. While we did not compile definite records, there seemed to be as many cases of epididymitis as when nothing had been done. Epididymitis is a very unpleasant complication of prostatectomy, and besides

being a heavy burden for our old men to bear, may constitute the difference between recovery and a bad ending. We have recently undertaken vasotomy, and hope that removal of about an inch of the vas with ligation of the cut surfaces will prove adequate. This brings up another closely related subject in which we have been interested for some time at the Brooklyn Hospital. Our pathologist is a very exact investigator and is hard to convince. His reports on the prostates removed almost invariably include the term "chronic prostatitis." This he contends is microscopically present even when the gland is clinically obstructive and requires removal. It is readily explainable, therefore, that epididymitis should be a complication when we are operating in an already infected field.

It will greatly reduce the morbidity and somewhat lessen the mortality if this very disagreeable complication can actually be prevented.

Dr. Aschner. In 1925 I found the incidence of epididymitis in prostatectomy was 20 per cent at the Mount Sinai Hospital. At that time they were reporting on vas resection abroad and I took it up. Since that time I have been resecting a half inch of the vas deferens on each side just below the external ring, which is a cleaner place to work in than the scrotum. It is easily done under novocaine and the sutured wound covered with gauze and collodion. I have had no epididymitis in the cases I have done. I had one wound infection.

I noticed in a younger man of about fifty whose spermatogenesis was probably very active, that a cystic swelling of the globus major, a spermatocele, occurred on both sides.

As regards the etiology of epididymitis in prostatectomy, most of the prostates removed for fibroadenoma show chronic infection; a second factor is that we probably damage or injure the ejaculatory ducts. These things cannot be prevented. The next point is the apparent relationship to catheterization and the use of indwelling catheters. It is now my practice, whenever I expect to do a prostatectomy, to perform bilateral vas resection before putting in an indwelling catheter or a cystoscope. Epididymitis may occur after vas resection if infection has been introduced by instrumentation prior thereto.

Dr. Morton. The occurrence of an epididymitis following a prostatectomy is very annoying to the surgeon and to the patient.

In 1925, before the Association of Genito-Urinary Surgeons, I advocated doing a vasectomy in every case of prostatectomy. The best time to do this is after the catheter drainage is begun. The risk of two slight operations is almost negative and the advantage is twofold. First, an occurrence of epididymitis is almost sure to be prevented; and second, if there is any value in Steinach's observations, a temporary improvement of all the vital functions takes place after vasotomy.

I think Dr. Morgan has made a very good showing with the results of two simple procedures in preventing the complication of epididymitis.

DR. RAVICH. I am very much interested in the splendid results obtained at the Long Island College Hospital with vasectomy as compared with the results obtained from vasoligation as practiced by Young and his coworkers. Following my visit to the Young Clinic at the Johns Hopkins during the American Urological Meeting held in Baltimore in May, 1927, I began to do bilateral vasoligation on my service at the Brooklyn Jewish Hospital. I had performed about 15 to 20 but from my general impression of the results obtained, it seemed to me that there had been no material decrease in the incidence of epididymitis following prostatectomy. The cases of epididymitis following this procedure may not be due to the operation but to the fact that most of the patients had been manipulated previously either by cystoscope or catheter before reaching the hospital and the process ending in the epididymitis may have begun before the vasoligation had been done. However, the results have been quite discouraging and prompted me practically to abandon this procedure entirely.

DR. VALENTINE. Routine bilateral vasectomy has been used on Dr. Stevens' service at Bellevue Hospital for some time. Dr. Cashman, ex-resident of the service, thinks we had seen only 2 cases of epididymitis following resection of the vasa. These, we thought, were due to the fact that the patients had been catheterized before vasectomy had been performed. The Brady Institute technique of ligation through the skin of the scrotum failed in our hands. Dr. Morton's suggestion of doing a vasectomy before any form of vesical drainage is instituted is very important. Regarding the site of incision necessary to expose the vas, we have never tried the high incision suggested by Dr. Ashner; we have always made it in the scrotum and have not seen any infections following this.

DR. READ. This report was based on the work of all the men on the service, and these figures are quite accurate. In one case we thought we had tied off the vas but it slipped away and only the fat was tied. That was one of the failures; while it is simple to pick up the vas and tie it, sometimes it slips away. This is a possible explanation of reported cases of epididymitis after resection.

GOITER & ENDEMIC CRETINISM[*]

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ONE travelling through a country where endemic goiter has long been prevalent, cannot fail to notice the large number of the inhabitants showing the stigmata of endocrine disturbance, dwarfs, cretins, myxedematous individuals, deaf mutes, etc. This is so noticeable in Switzerland that Professor de Quervain of the University of Berne relates this anecdote: "A traveller passing through Switzerland saw a cretin. Turning to his companion he remarked, 'There you see the typical Swiss.'" Such a statement, of course, is absurd for the true Swiss is a remarkably fine specimen of the genus Homo.

For generations the incidence of endemic goiter has been high in Switzerland and in common with other countries where this condition exists, degeneration changes of the thyroid have steadily progressed resulting in a large proportion of the people being physically and mentally affected. In these countries one never sees the toxic goiters which are so common in the United States and exophthalmic goiter is almost never seen.

It will be interesting to learn what results will be obtained in lessening the incidence of cretinism by the use of iodine in goiter prophylaxis which is now being carried on in Switzerland under Government supervision. Whether cretinism is due entirely to a thyroid deficiency or is a polyglandular disturbance, is a moot question. There is no question, however, that the thyroid disturbance is *not* the main factor. To quote Biedl.[1] "The thyroid gland, if not the conductor, is at least the first violin of the incretory concert."

The endocrine glands are so dependent one on the other, that a deficiency of one disturbs the normal function of the others; making it difficult to determine which symptoms are due to disturbance of function of individual glands; and the fact that nearly all symptoms are improved by the administration of thyroid extract does not prove tha the thyroid gland alone is at fault.

The anatomical changes found in the thyroid glands in cases of cretinism show an exceedingly wide variation. The gland may be entirely absent; marked fibrosis or some remnant of the gland may be present but with few of the acini preserved; and occasionally the gland may escape severe damage. In the latter case, usually some other gland of internal secretion is found deficient. In such a case Adami found a lesion of the pituitary gland.

Many cretins have large goiters, the goitrous growth involving practically all of the thyroid. Many of these become cystic and are so large that the patients wear cloth slings about their necks to support the weight. The goitrous cretin usually attains a slightly larger stature than the athyroid type, the mentality, however, being the same.

There is quite a marked difference in the mentality of the cretin, ranging from the so-called vegetable man to those who are capable of self support. If the child is born with no thyroid, he develops neither mentally nor physically, the so-called plant man. This congenital athyroidism is a malformation and is not confined to countries where cretinism is endemic and the cause is obscure. Where thyroid insufficiency develops at a later period, after a certain amount of physical and mental development have taken place, dwarfism and idiocy will be less marked the child may not be an idiot, but simply weak-minded. If still further mental and

[1] Biedl, A. Organotherapy. Harvey Lectures, 1923–1924, p. 27.

physical development have occurred before the insufficiency of the thyroid, the child will only be slightly affected both mentally and physically, the so-called backward child. These lighter cases of cretins may be taught to partially support themselves, and are able to work on the farms and to handle teams.

Geographic Distribution. In 1921, Dr. Murray B. Gordon, made a survey of the incidence of cretinism in the United States and Canada and reported 280 cases, exclusive of 60 cases previously reported by Dr. Osler. The location of these cases is as follows:

Canada	52	Oregon.	3
New York	120	Rhode Island	3
Pennsylvania	25	Maine	2
Indiana	12	Missouri	2
Ohio	10	Nebraska	2
Massachusetts	6	Arkansas	1
Minnesota	6	North Dakota	1
Virginia	6	Montana	1
Kentucky	5	Washington	1
Iowa	5	Kansas	1
California	4	Colorado	1
Maryland	3	Louisiana	1
Illinois	3	District of Columbia	1
Wisconsin	3		

Analyzing the distribution of these cases, it is apparent that cretinism is not confined to the goiter belts and Dr. Gordon comments that: "Even though goiter is endemic in Canada along the St. Lawrence, in the Allegheny Valley of Pennsylvania and along the Great Lakes, not a single case of endemic cretinism was found and the incidence of so-called sporadic cretinism was no greater than in other regions."[1]

Dr. Gordon's findings have been similar to my own experiences. I have been practicing for twenty-seven years in a distinctively goitrous belt and I have seen but one case of true cretinism in my own practice during that time. Complying with a request from Professor de Quervain of Berne, Switzerland, to secure for him a motion picture film of cretinism in the United States, I had great difficulty in finding any cases of true cretinism. Cases of cretinism were reported to me from various parts of the country but, upon observation, I found the majority of them to be Mongolian idiots and others, simple defectives; however, in an institute in Columbus, Ohio, for the feeble-minded, I located a group of 10 cases which were true cretins. These cases were quite interesting and varied from the vegetable man to those who showed a slight degree of intelligence. Another interesting fact from Dr. Gordon's survey, is that there are twice as many females affected as males. The hereditary influence is quite distinctive where cretinism is found in Switzerland, and consanguinity appears to be a very active factor in the etiology.

In a personal communication from Professor de Quervain he states:[1]

The etiology is in my mind the same as the one of the endemic goiter, but at a higher degree. I agree more or less with the standpoint of McCarrison and Galli-Valerio and I think the iodine in physiological doses is able to prevent the effect of that intoxication; and that cretinism may be more or less improved but not healed by thyroid treatment. Iodine prophylaxis will probably be helpful against goiter and cretinism, but we will not be able to have the results before ten to twenty years. It is too early to talk at this moment of a reduction of incidence of cretinism.

Prof. Ludwig Pick of Berlin, in a personal communication states:[2]

Endemic cretinism can only be found in Germany where endemic goiter is. From this fact, two fundamental theories have been deduced: 1. That endemic cretinism is only a further development of the changes in the thyroid which one finds in endemic goiter. The etiological factors responsible for endemic cretinism are more complex than those found in endemic goiter. 2. Endemic cretinism is not developed as a further stage in endemic goiter, but runs parallel and independent of endemic goiter, which is caused by the same or similar

[1] Paper given before Association for Study of Internal Secretions, June 6, 1921.

[1] Personal communication from Professor F. de Quervain, Berne.
[2] Personal communication from Professor Ludwig Pick, Berlin.

factors. But in addition to these facts, one must consider that endemic cretinism consists of a higher degree of parenchymatous changes in the thyroid. The same etiological factor or factors are at the basis of endemic cretinism, endemic goiter, and deaf-mutism in the same affected regions. There are however, individuals with endemic cretinism without endemic goiter. These views are advanced chiefly by the two Swiss investigators, Senior and Junior Bircher, Which one of these two theories is the more rational one, is still a much mooted question.

PATHOLOGY

Interesting pathological changes occur in the bones, a retardation of the centers of ossification and is well shown in young children by the roentgen ray. In common with achondroplasia there is a disturbance of the normal growth at the junction of the epiphysis and diaphysis. New bone cells on which depend the growth of the bone do not develop. As a result, the long bones do not grow in proportion to the rest of the body. This disproportion, however, is not so great as is seen in achondroplasia.

Retardation of calcification prevents the union of the epiphysis and diaphysis, and they may remain separate many years longer than normal. For the same reason the fontanels remain open long beyond the usual age for closing. Flattening of the bridge of the nose is also caused by abnormal bone development.

Besides the characteristic bone changes, myxedema is a very constant symptom, and a subnormal metabolism is always found, where the intelligence of the patient permits a basal metabolism test to be satisfactorily made.

DIAGNOSIS

In the majority of cases, the diagnosis is not usually made until the child is several months old; and the child may be one or two years old before any abnormality is noticed. A sufficient amount of thyroid secretion in the early months may be furnished by the mother's milk to hold the disease in check until after the child has been weaned.

The physical and mental defects of a typical case can seldom be mistaken. The diseases which may be confused with cretinism are rickets, Mongolian idiocy and achondroplasia.

In rickets, the shape of the head, the characteristic bony changes, and the rosary are usually sufficient to cause recognition of this disease. In cretinism the hands are short and spade-like, while in rickets the fingers are long and beaded.

In mongolism the hands are normal, the head brachycephalic, the anteroposterior and lateral diameters being nearly equal, and there is the Mongolian slant of the eyes. As with cretinism, there is some incoordination of the movements; but such individuals lack the peculiar color of cretinism, their cheeks often being pink. There is no disproportion of the body, while in the cretin the limbs are too short for the body.

The administration of thyroid will have no affect on the Mongolian idiot while on the cretin the subnormal temperature will become normal after a few doses of thyroid substance.

Achondroplasia is present at birth, the characteristic feature being the extreme shortness of the extremities, the hands reaching only to the hips and the legs being proportionately short. The head seems larger, but measurement shows that it is not actually larger. Myxedematous puffiness about the face is not present as in cretinism; and, as the child grows older, there is no marked defect in mental development. After the first year of life, the roentgen-ray will show the characteristic delay in the development of the centers of ossification and the failure of union between the epiphysis and diaphysis of the long bones.

PROGNOSIS

Prognosis depends upon the recognition of the symptoms at an early age, and continuous and regular treatment. Untreated cases become idiots and dwarfs. A remarkable improvement will be obtained in the

physique and mentality of the child if the disease is recognized early and thyroid extract given continuously in suitable doses. Some cases will be almost normal; but usually more improvement is seen in the physical rather than the mental development. Cretins are very susceptible to infectious diseases, and few untreated cases live to adult life except in the milder forms.

TREATMENT

It remains to be seen what the systematic prevention of goiter will do toward lowering the incidence of cretinism. The early and continuous administration of thyroid, beginning with small doses and gradually increasing to tolerance will improve a large number of these cases; but many will still remain in a condition little better than high grade defectives.
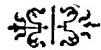
WHAT SHALL BE DONE ABOUT GOITER PROPHYLAXIS?*

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THE question: "What shall be done about goiter prophylaxis?" is being asked with disconcerting frequency. The form of the query arouses the suspicion that all is not well with this measure. The Public Health Service with its ear, figuratively speaking, close to the ground frequented by health officers has noted growing dissatisfaction with the methods and results of goiter prevention during the past four years. Certainly there is no gainsaying the fact that the procedure has suffered a profound slump in popularity. However, as the principles underlying the prevention of goiter are sound it is desirable that disturbing factors be detected and, if possible, eliminated.

SCOPE OF DISCUSSION

In the present discussion only the prevention of simple, otherwise known as endemic, adolescent or colloid goiter is contemplated. However, the prevention of adenomatous goiter will be touched upon incidentally. The suggestion of Bram of Philadelphia, that exophthalmic goiter may be prevented by appropriate action is worthy of consideration, particularly in view of the apparent increase in the number of individuals afflicted with this malady.

No greater service can be performed in behalf of goiter prophylaxis at the present time than by restating and clarifying the principles upon which this procedure is based. Like many other apparently simple devices goiter prophylaxis requires a certain degree of precision in its application, as well as an appreciation of its limitations. Heretofore this understanding and attention to detail has been largely lacking.

CAUSES OF GOITER

Iodine and Goiter. By many persons simple goiter is erroneously believed to be due solely to the absence or deficiency of iodine in food and water customarily consumed. This conception is a particularly unfortunate one for it interferes materially with the successful prevention and treatment of simple thyroid enlargement. Iodine, of course, is intimately concerned with the maintenance of normal thyroid equilibrium. However, there are many underlying and relatively remote factors other than a deficiency of this vital element which are indirectly responsible for thyroid enlargement. The frank recognition of these facts will do much towards stabilizing and rationalizing the efforts in forestalling the occurrence of goiter.

Causes of Simple Goiter. In all probability simple goiter is due either to an absolute or relative deficiency of iodine. By an absolute deficiency is meant the shortage or absence of iodine from food and water. Deprived of an element essential to its efficient functioning the thyroid undergoes compensatory hypertrophy. But enlargement may also follow a relative deficiency of iodine. Demands for iodine in excess of available amounts often cause simple thyroid enlargement during puberty, pregnancy and lactation. Interference with the intake and utilization of iodine available in ample quantity, such as probably occurs in infections and intoxications, or when partaking of abnormal food combinations, also causes simple goiter.

Polluted Water as Cause of Goiter. McCarrison, the English investigator, believes that simple goiter is due to the

* Read at the Annual Meeting of the American Association for the Study of Goiter, Denver, June 18–20, 1928.

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consumption of polluted water. Quite recently he has reported the disappearance of goiter from a village in India, following the substitution of a pure for a polluted water supply. McCarrison's experience in this respect has not been duplicated in the United States, for it has been found that simple goiter often increases when safe water is available. McCarrison, having recently produced simple thyroid enlargement experimentally by overfeeding with white flour, has decided that simple goiter, as encountered in the Old World, has a different etiology and consequently is a different condition from that found in the United States. However, there appears to be no scientific basis for such a distinction.

PREVENTION VERSUS TREATMENT

The failure clearly to differentiate between prevention and treatment has caused much confusion and misunderstanding. Many physicians, failing to reduce existing thyroid enlargements with iodine in prophylactic doses unqualifiedly condemn the measure. Quite obviously prophylaxis is intended solely for the maintenance of normal thyroid equilibrium. Existing thyroid enlargements are probably uninfluenced by ordinary prophylactic measures; if they are, the result may be regarded as incidental. Existing goiters require individualized treatment by a physician of experience and skill. Even under the most favorable circumstances the results of treatment may prove disappointing. In view of these facts the distinction between prophylaxis and treatment must be clearly understood and appreciated.

PROPHYLAXIS

Results of Prophylaxis. Doubt concerning the efficiency and safety of goiter prophylaxis has arisen in the minds of many observers during the past few years. Concerning the efficiency of the measure under suitable conditions there can be little doubt. Unfortunately, there are relatively few reliable reports of success following the systematic institution of prophylactic measures. The failure to record the progress of prophylaxis by periodical reexaminations of the same individuals constitutes a serious defect in present day management. Yet, despite the rather general absence of reliable reports there are a few records of strikingly successful outcomes which aid in preserving one's confidence in preventive measures. Among these may be mentioned the reduction of simple goiter among the school children of Seattle, Washington from 25 per cent in 1915 to 4 per cent in 1926. A decided decrease in goiters of considerable size has also been noted in Cincinnati after three years of effort.

Ill Effects Following Prophylaxis. From time to time disturbing reports of untoward effects following goiter prophylaxis have been forthcoming. It is well known, of course, that apparently benign goiters may suddenly be excited to hyperactivity through the use of abnormally large quantities of iodine. However, in these instances the suspicion remains that the toxic potentialities reposed in the apparently quiescent gland, merely awaiting a suitable stimulus for the production of the hyperthyroid condition. Moreover, in many of these cases iodine has been administered far in excess of physiological requirements. The histories of persons with toxic goiters often reveal the prolonged ingestion of unnecessarily large doses of iodine which were self administered, taken in patent medicine preparations or prescribed by physicians who failed to realize the poisonous potentialities of the element.

Essentials of Effective Prophylaxis. If there is a lesson to be learned from these untoward experiences it is that iodine is a poison and as such must be administered with caution. In order to be effective as a prophylactic and at the same time safe, the element must also be used with intelligence. The essentials of effective goiter prophylaxis, rather obvious but poorly understood, may be stated as follows: Efficiency, harmlessness, minute dosage,

palatability, low cost and ease of administration of the preparation used. Coupled with the rigid observance of these principles there must be intelligent supervision. Were these requirements accurately observed complaints of harmful effects following prophylaxis would be voiced less frequently.

General versus Individual Prophylaxis. Opinion, experience and practice as to the most effective method of administering prophylaxis varies widely. By some, individual prophylaxis is favored because nominal supervision is assured. However, this method must of necessity be limited in scope of application. Moreover, until a suitable automatic method of distributing needed iodine is devised no real progress in combatting simple goiter will be made. Pending the discovery of a measure meeting these requirements it appears advisable to favor individual oral prophylaxis.

Some authorities are inclined to favor general prophylaxis through the medium of iodized water, salt or other widely used food stuffs. Provided, of course, such foods contain sufficient iodine to prevent goiter without causing a disturbance of thyroid function, their limited use may tentatively be approved. There appears to be a real danger in the suggestion that many commonly used food products be artificially iodized. The Public Health Service has consistently advised against the iodization of any food but common salt, which is regarded as a preparation of merit and promise.

Iodized Table Salt. Iodized salt, justly or unjustly, has come to be regarded with suspicion because of reports of deleterious effects following its ingestion. Recognizing the possibility of harm to hypersusceptible individuals, those sponsoring the use of iodized table salt have recently caused the iodine content to be reduced to 1 part in 100,000 parts of salt. This minute quantity is believed to be adequate for the maintenance of normal thyroid equilibrium and at the same time is thought to be incapable of stimulating hypersusceptible

thyroids. Such a preparation is now being marketed.

Prophylaxis during Pregnancy. Because of the prominence which has been given to the prevention of simple goiter during adolescence there has been a tendency to overlook certain closely allied features of prophylaxis. However, it should be emphasized that iodine, when properly administered during pregnancy, performs a far reaching service. The physiological demand for iodine during gestation is insistent even among women residing in nongoitrous territory. It is probable too that the so-called fetal adenoma of the thyroid gland may be prevented by the administration of iodine during pregnancy. This phase of prophylaxis assumes added importance when it is realized that malignant degenerations of the thyroid are frequently inaugurated in adenomatous tissue.

Far-reaching Effects of Prophylaxis. The deeper significance of goiter prophylaxis should not be overlooked. The effects of uncombatted simple goiter appear to be visited with increasing severity upon succeeding generations. Thus cretinism, mutism and idiocy, as well as other mental and physical degenerations, are the aftermath of uncontrolled simple goiter. The incentive for protective measures is increased when this relationship is understood. Another important reason for preventive measures is supplied in the conception that all goitrous diseases are stages of one process and usually culminate in toxic states.

When is Prophylaxis Indicated? Goiter prophylaxis is only one of many pressing public health problems. Hence, it becomes necessary to decide when specific measures of this character are justified in a given community. When major public health projects are already being slighted and the incidence of this affection is comparatively slight, it is manifestly unfair to begin an active antigoiter campaign. On the other hand when an efficient health organization exists and goiter is present to a considerable

extent prophylactic effort is plainly indicated.

The Test Survey. As a preliminary to the consideration of preventive measures there should be a test survey. Such an investigation made among high school students in conjunction with routine physical examinations, will indicate the relative incidence of simple goiter. Standard methods of procedure, such as those described by the United States Public Health Service, should be utilized preferably under the guidance of a person skilled in investigations of this type.

Information of value is provided by a well conducted goiter survey. Data gathered in this way indicate the incidence of goiter in the general population in a given community. The nearer the ratio of goiter incidence among boys and girls approaches 1:1, the greater is the general distribution of the malady. Then, too, the result of a goiter survey makes it possible to determine with fairness whether general prophylaxis is warranted.

Index for Prophylactic Effort. Rates of goiter incidence among boys and girls may be used as arbitrary indices of the need for general prophylaxis. When the percentage of all degrees of thyroid enlargement as determined by Public Health Service standards does not exceed 10 per cent and that among the girls does not exceed 20 per cent general prophylaxis is probably not indicated. Percentages ranging between 10 and 20 per cent among boys or between 20 and 30 per cent among girls probably leaves wide-spread prophylaxis in the optional class. When all degrees of thyroid enlargements among boys exceed 20 per cent and among girls exceed 30 per cent general prophylaxis is probably

required. However, these suggestions should not deter physicians and public health officials from providing prophylaxis and treatment in specific instances, even when relatively few simple goiters are present in the general population.

CONCLUSION

Answering specifically the question: "What shall be done about goiter prophylaxis?", it should be emphasized that this procedure can no longer be regarded as a hit and miss affair. After learning the extent of goiter incidence, by means of a test survey, prophylaxis should be made available by the intelligent application of fundamental principles. Obviously results cannot be measured unless careful periodical reexaminations are made of those receiving prophylaxis.

If goiter prophylaxis is to occupy its rightful place as a beneficient measure additional thought and study must be devoted to perfecting the practical details of application. Other phases of goiter, as attested by a voluminous literature, have been accorded much earnest consideration. The general public appreciates the splendid advances in the diagnosis and treatment of existing goiters. The technical precision involved in operative procedure excites widespread admiration. Yet the prevention of goiter, while lacking in the spectacular and difficult to appraise in terms of efficiency, is a fundamental service which the people have a right to expect. There is nothing fundamentally wrong with goiter prophylaxis. The measure is scientifically sound, efficient and safe. However, continued efficiency and safety can only be assured by competent guidance.

REDUCTION OF THE MORTALITY IN THYROID SURGERY*

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IN the surgical treatment of hyperthyroidism many factors must be considered. The actual operation of thyroidectomy is of minor importance as compared with:

1. Early diagnosis and early operation.
2. In determining the operability of the patient.
3. The management of the patient in preparation for operation.
4. In choosing the optimum time for operation.
5. In choosing the type of operation to be performed, whether a single or multiple stage operation.
6. The postoperative management.

I will not discuss the question as to whether or not there is any fundamental difference between the various clinical types of hyperthyroidism, but for practical purposes will speak of two clinical groups: (a) toxic goiters and (b) exophthalmic goiters, which Lahey calls primary hyperthyroidism.

Toxic goiter (to be distinguished from exophthalmic goiter) is a clinical group of various histological structure, showing hyperthyroid manifestations of long duration, insidious in development, without a typical course; this type is apt to produce cardiovascular degeneration. These patients come to the physician particularly on account of the circulatory disturbances. The toxic adenomatous goiter is the principal representative of this type and is somewhat different in it's development of toxicity from that of the exophthalmic gland. The toxic adenomas are always preceded by non-toxic goiter and the non-toxic period may vary from one to more than thirty years.

Exophthalmic goiter is a clinical entity, the etiology of which is unknown. It is a condition in which all thyroid cells seem stimulated to increased activity, as though by some extraneous agent. It runs a typical clinical course with remissions, exacerbations and recurrences. The name exophthalmic goiter is inappropriate, because some cases show no exophthalmos and because exophthalmos, as a symptom, is often a late manifestation. On account of the seriousness of exophthalmic goiter and because of the fact that early surgical interference will prevent the serious visceral changes which usually occur, early diagnosis is important.

Furthermore, early diagnosis and classification is important because this type of goiter is progressive and liable to recurrences of the toxemia. The severity of the course to an individual cannot be foretold. Permanent tissue damage, resulting in invalidism, will occur if the toxemia is prolonged. Treatment should be instituted at the earliest moment that the diagnosis can be completed.

All toxic goiters, other than the exophthalmic type, demand early surgical treatment to prevent myocardial complications. The toxic adenoma is the most important one in this group. Goiter cases, in whom the heart has become decompensated during the course of typical acute exophthalmic goiter, are less liable to permanent myocardial injury following recovery, than are those of long standing nodular goiter with increased metabolism.

An early operation for adenomas of the thyroid, without symptoms or with very mild symptoms, should be as near free from danger as is any surgery. This may seem like a radical surgical idea but when

one sees large numbers of patients with badly damaged hearts, the results of long standing toxic adenomas, many of whom die needlessly early deaths, one feels that the idea deserves serious consideration. Even though patients with severe toxic adenomas come safely through the operative procedure, they usually have suffered irreparable damage to the heart muscle. With early operation in cases of adenomas of the thyroid, the mortality should be practically nil and in exophthalmic goiter the death rate should be extremely low.

There are certain groups of cases in which the operation of thyroidectomy is especially hazardous, and in such cases the preparation for operation and determining the time and type of operation is of great importance. The groups of goiter cases in which the hazard of operation is especially great are:

1. Cases of hyperthyroidism in adults in which the toxic symptoms are marked and of long standing.

2. All cases of marked hyperthyroidism in children.

3. Cases of toxic adenomas in elderly patients with a marked myocarditis.

The principal conditions which contribute to the risk attending hyperthyroidism are:

1. Marked loss of weight within a short period of time and accompanied with extreme exhaustion.

2. Myocardial changes with cardiac decompensation.

3. Dehydration and impending acidosis.

4. Instability of the nervous system.

Much can be done to alleviate these conditions and render the patient a better operative risk. The excessive metabolism, which has resulted in this rapid loss of weight, demands rest in bed and sedatives to control the hyperactive nervous system. Of all measures designed to combat the high metabolic rate, rest and iodine are the most useful. To obtain the best results from rest, particular attention must be given each individual. Exophthalmic goiter patients do not adjust themselves readily to rest in bed and they must be personally instructed and persuaded to control their ceaseless, wasteful movements and excited conversation.

Besides rest in bed, careful attention should be given to the diet. Most thyrotoxic patients show a striking undernutrition when they present themselves for treatment. This loss of weight is due to an inability to meet the high caloric requirement of their increased rate of metabolism. The food intake being insufficient the body tissues are consumed to meet the deficit. To meet this high rate of metabolism the intake of an enormous amount of food is demanded. In spite of the fact that most of these patients have a good appetite it oftens requires considerable ingenuity to furnish a diet, containing the required caloric contents, which is not too bulky and which will not cause any gastric upset. In general the diet should contain a low protein content and carbohydrates should be given in plentiful amounts. The question of proper and sufficient food is of great importance in the preparation of the thyrotoxic patient for operation and, also, during the postoperative period.

Dehydration. Thyrotoxic patients frequently show evidences of marked dehydration when they present themselves for treatment and many have an acidosis. Fluids should be forced in all cases and should be at least 3000 c.c. daily. The fluid intake need not be confined to water. Ginger ale and fruit juices are doubly useful, in that carbohydrates are also furnished. In patients with intense toxicity, with rapid loss of weight, there is often a gastrointestinal crisis manifested by diarrhea and vomiting. These patients are dehydrated and it is obvious that a considerable breakdown of the tissues has occurred to meet the demands of their high metabolism. In such cases the indication for fluids is imperative and in addition to fluids by mouth, saline solution should be given subcutaneously. If acidosis is present, glucose should be given along with the normal salt infusion, or by the intravenous

administration of 500 c.c. of a 10 per cent solution. If given by the intravenous route the flow should be so arranged that one hour will be consumed in giving the 500 c.c. of glucose solution. If given more rapidly a considerable portion of the glucose is apt to be excreted in the urine.

When delirium develops in a patient with acute hyperthyroidism, we are confronted with one of the most serious problems in connection with the disease. The transfusion of whole blood is indicated and often brings about an immediate improvement. By the use of iodine, saline infusion, blood transfusion and sedatives, most patients will recover from their delirium. In some instances a true pyschosis may develop and in such cases, a guarded prognosis should be made both as to the immediate and ultimate result. Unless the delirium in the acute thyrotoxic case can be relieved by medical treatment, it is futile to attempt surgery. Experience has shown that the mortality is practically 100 per cent when surgery is attempted upon the delirious thyrotoxic case.

There is considerable controversy about the use of digitalis in thyrotoxic cases. Crile does not think that digitalis given cautiously can be harmful to the goiter patient. He administers it before operation to most patients in whom myocardial changes have developed. Plummer believes that digitalis is contraindicated in practically all toxic goiter cases and claims that the operative mortality in their clinic was reduced as soon as they discontinued the use of digitalis both preoperatively and postoperatively. During the past two years, we have followed Plummer's suggestion and discontinued the use of digitalis in exophthalmic goiter cases, except in patients with auricular fibrillation. It is in these cases, and in these only, that we have found appreciable benefit from digitalization.

Auricular fibrillation is the most common heart complication and it is essential that this condition be, as much as possible, controlled before operation. It should

be remembered that this state of the heart is a result of thyrotoxicosis and that digitalis alone may fail to produce results. Iodine in combination with digitalis will often bring about a normal rhythm. Cases in which fibrillation is of recent occurrence do well, those of long duration do less well, even though the basal rate is relatively low.

Iodine is the only drug of demonstrated merit which tends to reduce the metabolic rate in hyperthyroidism. It's present extensive use in the treatment of exophthalmic goiter is due particularly to the work of Plummer of the Mayo Clinic, who first placed it on a firm clinical basis.

Iodine has proved to be an important addition to the preparation for operation of patients with exophthalmic goiter. By it's use one is able to perform thyroidectomies, as a primary operation, in many cases which otherwise would have required preliminary ligations. Iodine, in the form of Lugol's solution, seems to be the most satisfactory and should be given preoperatively until it is evident that the most marked degree of gain has been made, as evidenced by improvement in symptoms and drop in the metabolic rate.

The dosage of iodine used in the preoperative treatment of exophthalmic goiter varies from 10 to 30 drops of Lugol's solution given, well diluted in water, after each meal. If the patient is having a thyroid crisis, accompanied with vomiting and diarrhea and will not tolerate iodine by mouth, the intravenous administration of iodine in the form of sodium iodide has proved satisfactory. There are certain points regarding the preoperative use of iodine, however, which should be considered. Early in it's use, it was frequently noted that severely toxic cases appeared to be in better condition than was actually the case, as has been pointed out by Lahey, so that it was found to be inadvisable to operate at the time of the apparent maximum improvement.

Iodine as a preoperative medication, when effectual, appears to accomplish it's

greatest good in a period of eight to fourteen days. Following this there is a period when there is no further improvement and beyond this, a period when a great many cases lose a good part of the improvement which they had shown under the administration of iodine.

The beneficial results from the use of iodine in exophthalmic goiter cases can seldom be duplicated if operation is delayed and later a second course of iodine therapy is given. It is not uncommon to see cases so greatly benefited by a course of iodine that they refuse to be operated upon, thinking that an operation can be avoided. Later on, they return with the same or more marked symptoms and when a second course of iodine is given, they fail to show the same improvement as they did with the first course of treatment.

In a certain group of cases, even after most careful preparation, there is a question as to whether or not a thyroidectomy can safely be performed. In most of such instances, a lobectomy should be performed. I am convinced that a lobectomy is a safer operation, in many cases, than a complete thyroidectomy. If, after lobectomy, there should be less reaction than was expected the other lobe can be removed two days later. In most cases, however, it is best to wait six weeks before removing the second lobe.

The operation of preliminary ligation is seldom done in our clinic at the present time. Last year 700 patients were operated upon for goiter and a preliminary ligation was made on only 5 cases. Some clinics have entirely discarded the operation of ligation, but I still believe that in a small percentage of cases a ligation is indicated, especially in children.

Children with hyperthyroidism should be handled with special care. Hyperthyroidism in children is usually characterized by an abrupt onset and even after the most painstaking preparation, they are apt to react seriously to any operative procedure. The operation should be so planned as to require a minimum amount of anesthetic and the surgeon should be prepared to interrupt the operation at any time. Excellent results often follow ligation in children, the improvement often being more striking than in adult patients. A special word of caution should be offered regarding the danger of performing tonsillectomies in the presence of hyperthyroidism in children; for the reaction may be much more severe even than that which follows the thyroidectomy. In these cases it should be the routine procedure to perform the thyroidectomy first.

In toxic adenomas of long standing in elderly people, the precautions and special measures outlined above for exophthalmic goiter cases, are equally applicable. It was formerly thought that the toxic adenoma cases could not be given iodine safely. Experience has proved that Lugol's solution, given over a short period of time, will have a beneficial effect, but the improvement is not so striking as in the majority of exophthalmic cases.

In all cases of toxic goiter the selection of the optimum time for operation is a very important matter. The ill-advised timing of operation is responsible for considerable mortality. It was formerly thought that the basal metabolic rate provided a fairly safe guide for operability in toxic goiter cases. Experience has proved this is not true. Increased metabolism is only one sign of increased activity of the thyroid gland and is not pathognomonic of thyroid disease. It is like any other laboratory test, it must be taken along with the clinical picture, or it may be very misguiding.

It is true the metabolic rate will tell us at what rate the patient is burning up his tissues, but it does not tell us the patient's ability to stand this increased rate of metabolism. In determining the operability of a toxic goiter case, there are other factors of far greater importance than the metabolic rate:

1. A rapid loss of weight, especially if accompanied by marked exhaustion, indicate bad risk patients.

2. The emotional stability of the patient must be taken into consideration.

3. The condition of the myocardium and the estimable reserve of the patient are of great importance.

4. Conditions affecting the social life of the patient from the standpoint of worry, are of importance. Worry may cause intense anxiety to a hypersensitive thyroid patient, and thus exert a real influence upon their postoperative condition.

A patient who is extremely apprehensive and excited, talks rapidly and almost incessantly, is restless and emotionally unstable, is not a good operative risk, even though the heart has responded well to rest and treatment, the pulse is reduced and the basal metabolic rate is comparatively low.

There is no single index for the optimum time for operation. We believe that no laboratory or single clinical test takes the place of the experienced surgeon's judgment as to operability under the conditions surrounding each case.

The handling of a goiter patient before operation is an important factor. If one has the confidence of his patient, I see no reason why he should not understand fully about the operative procedure, the same as any other patient. I always inform the patient as to the time and nature of operation to be performed and explain why it is necessary that they should have preliminary treatment before operation. The patient should be assured that no operation will take place until condition is such that the operation is safe. I have found that under this plan, these patients are not apprehensive about the operation and are anxious to have it done.

The Operation. On the morning of the operation, the patient is given a large dose of Lugol's solution, and 14 grain of morphine is administered three-quarters of an hour before the patient is taken to the operating room. For several years local anesthesia was used in practically all of my goiter operations. Recently, I have been using ethylene in a considerable number of cases and I can see no difference in the results.

The incision should be large enough to give adequate exposure of the goiter. The operation itself should be brief and without rough handling of the gland. The upper and lower pole of the gland should be entirely removed on both sides, leaving a small amount of thyroid tissue scattered along in the front of the posterior capsule if the gland which, of course, is always left in place. I have discontinued the practice of leaving one of the poles of the gland, because I believe that the remaining mass of thyroid tissue as the poles predisposes to recurrence of the disease. I leave a small drain in most cases. Lugol's solution should be given freely for forty-eight hours after operation. If, perchance, the patient cannot retain Lugol's solution by mouth it is best administered by giving sodium iodide intravenously.

After operation little reaction is to be expected, if the case is handled in the usual way. Occasionally a very active hyperthyroid patient may present a severe reaction. These postoperative febrile reactions are best controlled by the use of large ice-packs, as recommended by Crile. When the toxic patient develops a high temperature and delirium, either preoperatively or postoperatively, we find the use of the massive ice-pack, consistently, results in a decrease of fever and, coincidentally, the delirium disappears. It is necessary to use tremendous amounts of ice applied to the etire body, several hundred pounds of cracked ice sometimes being necessary. One must watch the temperature of the patient by frequent thermometer readings and discontinue the icepack when the temperature falls to 100°F. These delirious patients then go into a placid sleep and recovery is prompt. We have not yet seen a hyperthyroid febrile reaction which has failed to yield to a sufficiently large ice-pack.

We use morphine freely both preoperatively and postoperatively, it's use being designed to produce rest and sleep. We

find that patients who sleep well and long, hardly ever present any postoperative reaction. We take every means of getting water into our patients. Hypodermoclysis is used routinely postoperatively in all extremely toxic cases.

Complications. The two most common, serious, complications in thyroid surgery are:

1. Injury to one or both recurrent nerves.
2. Postoperative hemorrhage.

Injury of the recurrent nerve may be very distressing to the patient by causing dyspnea and an excessive amount of mucus in the throat. This complication is not borne well by a patient who has a marked myocarditis and may be the indirect cause of a mortality. In any case, where dyspnea seems to be causing embarrassment to the heart, a tracheotomy should be done.

Hemorrhage. The occurence of postoperative hemorrhage always demands immediate attention. When sudden dyspnea occurs in a thyroid case, the bandage should be removed and if hemorrhage is suspected, the patient should be taken to the operating room for reopening of the wound to control the hemorrhage. If the patient is badly cyanosed, immediate action is demanded. The wound should be opened at once and the clot removed. The wound can be packed open and a secondary closure made later.

The next most annoying complication is tracheitis. If this condition becomes alarming, a tracheotomy should be performed and the mucus in the main bronchi should be removed frequently by passing a catheter through the tracheotomy tube and aspirating the mucus with a suction pump.

Embolism. Embolism is of rare occurrence in thyroid surgery. As far as I know, it has not occurred in any of my cases.

Collapse of the Trachea. Collapse of the trachea does not occur as frequently as formerly since we do not encounter as many patients with very large goiters, whose trachea have been compressed and distorted for a long time. If collapse does occur, a tracheotomy is indicated. I have met with this complication only once during the past few years. This occurred recently in an exophthalmic case, whose thyroid gland was unusually hard and had caused pressure symptoms. Soon after the operation the patient experienced some difficulty during inspiration, there being no expiratory embarrassment. There was no nerve injury as her voice was normal. I was informed by the patient's husband that she had frequently had the same difficulty in breathing before operation, so I felt that her dyspnea was not serious. The dyspnea was gradually becoming worse and by the following morning, the patient was cyanosed and the heart markedly embarrassed. The wound was opened immediately and it was found that four or five of the tracheal rings would become absolutely flat during each inspiration. A tracheotomy was made, which gave immediate relief. The heart remained weak and rapid. The next day, she developed pneumonia and death occurred on the fourth day.

Infection. The incidence of infection is comparatively rare in thyroid surgery. The infection does not manifest itself until after any immediate thyroid reaction is over. With good drainage and hot, moist dressings, the infection will subside without serious consequence. The convalescence is prolonged and a disfiguring scar may result, but I have never had one of these cases develop a mediastinitis.

GOITER OPERATIONS DURING YEAR OF 1927

Colloid goiter	28
Adenomatous goiter	330
Exophthalmic goiter	343
Sarcoma of thyroid	1
Carcinoma of thyroid	4
Tuberculosis of thyroid	3
	709
Deaths	11 or 1.5 per cent
Thyroidectomies. 706 cases	8 deaths or 1.1 per cent
Ligations...... .. 5 cases	3 deaths or 60 per cent

SUMMARY OF DEATHS

1. *Exophthalmic Goiter. Thyroidectomy.* Fairly sharp reaction, but general condition good until third day, when patient developed an acute dilation of stomach. This condition persisted in spite of frequent gastric lavages. Death occurred on sixth day.

2. *Exophthalmic Goiter. Thyroidectomy.* Did not exhibit much thyroid reaction but died sixteen hours after operation from cardiac failure.

3. *Adenomatous Goiter* many years with cardiac decompensation. Ligation of both superior arteries had been done nine years previously.

Thyroidectomy. Condition good for twenty-four hours, when heart became rapid and irregular and death resulted twelve hours later from cardiac failure.

4. *Exophthalmic Goiter. Thyroidectomy.* Condition good for twenty-four hours when temperature suddenly rose to 106°F. Patient was placed in ice-pack and temperature dropped to 100°F. Pulse, temperature and general condition remained good for six hours when respirations suddenly became embarrassed, followed by death in a few minutes. The cause was undetermined.

5. *Exophthalmic Goiter. Ligation* right superior thyroid artery. Condition fair for six hours when heart began to fail, death five hours later.

6. *Exophthalmic Goiter. Ligation* right superior thyroid artery. Typical thyroid reaction, death in twenty-four hours.

7. *Exophthalmic Goiter. Ligation* right superior thyroid artery. Severe reaction and death in twenty-four hours.

8. *Exophthalmic Goiter. Thyroidectomy.* Twelve hours after operation, patient suddenly developed respiratory obstruction and expired before the house physician arrived in the room. Examination revealed a tight swollen neck. Death was due to hemorrhage.

9. *Exophthalmic Goiter. Thyroidectomy.* Sharp reaction for twenty-four hours. Patient developed a tracheitis with an excessive amount of mucus in throat and bronchi, accompanied by attacks of dyspnea and cyanosis. Tracheotomy was done, followed by marked improvement but attacks of dyspnea and cyanosis recurred frequently and death resulted on the fourth day.

10. *Exophthalmic Goiter. Thyroidectomy.* Typical hyperthyroid reaction, with death on the fourth day.

11. *Exophthalmic Goiter.* A girl sixteen years old with a very severe, acute exophthalmic goiter of three months duration, with marked loss of weight, delirium and persistant diarrhea and vomiting. After six weeks of treatment in the hospital including three roentgen-ray treatments, a ligation of the right superior artery was made. This was followed by a violent reaction. The left superior artery was ligated two weeks later. Reaction was not nearly so severe as followed first ligation. Considerable improvement followed ligations and patient returned home four weeks after second ligation. Patient did well for nine weeks when mother suddenly became insane, attacked the patient with a butcher knife, chasing her out of the house into the street. An acute attack of hyperthyroidism followed and one week later, patient was returned to hospital in an ambulance and in an extreme condition, even worse than on first admission. For two weeks condition was critical. Patient then began to improve and four weeks later a thyroidectomy was made and wound left wide open. Condition was very satisfactory for twenty-four hours, when patient suddenly became pulseless and died in a few minutes from cardiac failure.

SUMMARY

The principal factors which will tend to reduce the mortality in operation for toxic goiter are:

1. Early diagnosis and operation before permanent tissue damage has occurred.

2. The proper management of the patient in preparation for operation.

3. In choosing the optimum time for operation. The ill-advised timing of operation is responsible for a considerable mortality.

4. Judgment in choosing the type of operation to be performed, whether a single or multiple stage operation be done.

5. The operation should be comparatively brief, being careful to avoid injury to the recurrent nerves and the parathyroids.

6. The proper postoperative management. Prompt action in the care of any postoperative respiratory difficulty which may embarrass the heart. Delay, hoping that the condition may be better tomorrow, is often the cause of disaster.

Subtotal thyroidectomy by an experienced surgeon during the iodine stage of remission of symptoms, carries with it but a slight operative risk, if instituted before permanent damage to the circulatory apparatus has occurred. Under these conditions, exophthalmic goiter may be cured or at least controlled. The symptoms of hyperthyroidism should disappear and the basal metabolism rate should drop to normal following a subtotal thyroidectomy; otherwise an insufficient amount of the thyroid has been removed.

THE EFFECT OF IODINE AND THYROID FEEDING ON THE THYROID GLAND*

AN EXPERIMENTAL STUDY

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FOR several years we have accepted a didactic theory to explain the effect of iodine on the course of hyperthyroidism. This theory presumes that the toxic goiter secretes an abnormal substance, which has been designated deiodized thyroxin, and that iodine exerts its beneficial effect by supplying the iodine radical to this substance.

Recent investigations, however, have cast considerable doubt on this theory, as the following facts attest:

1. The theoretical abnormal substance has not been isolated; its chemical formula is unknown.

2. The theory fails to explain the relapse following an initial temporary improvement when iodine is given to patients with hyperthyroidism.

3. Several observers have demonstrated that the picture of hyperthyroidism can be constantly produced in the experimental animal by intravenous administration of normal thyroxin.[3,5]

4. Administration of iodine has no effect on the course of experimental hyperthyroidism, i.e., there is no effect on the circulating thyrotoxic substance.[3,5]

5. The studies of Reinhoff and Cattell who took specimens from patients before and after iodine medication have shown that an involutional change occurs in the gland itself.[1,4]

In view of this evidence it becomes increasingly more difficult to accept this theory. It is certainly much more logical to assume that iodine exerts its effect at the seat of production of the thyrotoxic substance than on the circulating toxin. It was, therefore, to determine something concerning the effect of iodine on the thyroid gland under various conditions that the following studies were made.

STUDIES

Adult dogs that had been fed the usual animal house mixed diet for several days were used. During the observation period they were kept on this diet, which was varied only by including iodine or thyroid extract. Small specimens were removed from the thyroid gland at the beginning of the observation period, at intervals after giving medication, and several months after the drugs were discontinued.

Group 1. After a section had been removed for microscopical examination, the dogs were given iodine in the form of Lugol's solution, 10 minims daily for six weeks, at the end of which time a second biopsy was done. After an interval of several months, during which no medication was given, another biopsy was done.

Group 2. After preliminary biopsy, the animals were given thyroid extract in increasing quantities until they exhibited symptoms of hyperthyroidism. A second section was taken. Iodine was then given for six weeks, at the end of which time a third section was taken. After a rest period of three months a fourth section was taken.

Group 3. In this group the rotation of drugs was similar ·to that in Group 2

except that the thyroid extract was continued during the six-week period when the animals received iodine.

which is a section from the same animal taken after a rest period of five months.

Group 2. A normal section is shown in


FIG. 1. Normal thyroid gland of dog; high power.
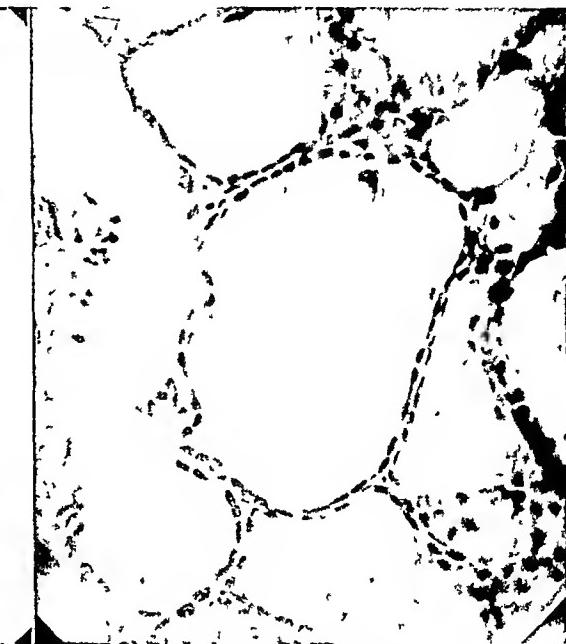
FIG. 2. Same animal, after feeding iodine for six weeks; high power.

RESULTS

The histological picture of the specimens removed from different animals after similar rotation of medication showed considerable variation, the most frequent variation being an absence of the typical iodine effect. As a rule, however, the histological picture was similar to that seen in the photomicrographs here presented.

Group 1. Figure 1 is a photomicrograph of the high magnification of the thyroid gland of a normal dog. Figure 2 is from the same dog after receiving iodine for six weeks. As compared to the normal gland, it will be noted that the acini are distended with colloid and, when seen under higher magnification, the cells lining the acini are distinctly flattened. It is reasonable to assume that ingestion of iodine has produced an increase in the amount of colloid which in turn has produced by compression a very evident distortion of the cells. This condition may persist for a considerable length of time as shown in Figure 3,

Figure 4. After receiving thyroid extract for one month the section shown in Figure 5 (high power) as taken. It will be noted that the effect of thyroid extract is practically identical with that of iodine (Fig. 2), that is, the acini are distended with colloid and the lining cells are compressed. The thyroid extract was then discontinued and iodine was given for six weeks, at the end of which time a section was taken. This section showed practically no change from that taken after thyroid medication. In a few of the sections the amount of colloid was slightly increased. All medication was then stopped for three months. At the end of this period a section was again taken (Fig. 6). The morphological change in this section is very striking. When compared to the normal gland of the same animal (Fig. 4), there is no similarity of structure. The amount of colloid is greatly diminished. The cells are detached and lie free in the acini. Under higher magnification the cells are granular

and the cytoplasm is vacuolated. This stage, which occurred very frequently after prolonged administration of thyroid ex-

Fig. 3. Same animal after a rest period of five months; low power.

tract and iodine, was interpreted as a period of exhaustion.

Group 3. In this group, the same morphological changes occurred as in the previous group. The stage of exhaustion was identical with that produced in the dogs in Group 2.

INTERPRETATION OF RESULTS

We are justified in concluding from the examination of the various specimens that iodine stimulates the gland to produce colloid. This process continues during the stage of experimental hyperthyroidism. As the colloid increases, the cells are compressed and flattened. This mechanical compression may very possibly prohibit, at least temporarily, the usual secretory function of the cells. After prolonged administration of iodine and thyroid extract the cells become exhausted, show changes of degeneration and are no longer capable of producing colloid.

EFFECT OF IODINE ON THE HYPERPLASTIC TOXIC GOITER

The morphological changes produced by
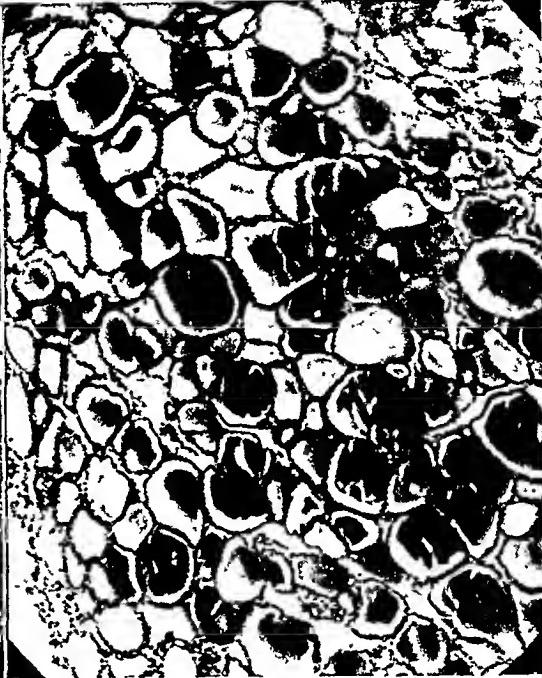
Fig. 4. Normal thyroid gland of dog; low power.

the administration of iodine to patients with primary hyperthyroidism have been well described. The acini are usually distended with colloid. The cells are transformed from columnar to low cuboidal and often are exfoliated and degenerated.

It is interesting to note the effect of iodine on a normal human thyroid. The acini are distended and the cells have changed from a columnar to a cubital type. The effect is quite similar to that produced in the experimental animal after iodine feeding (Fig. 2).

The most interesting group of patients from the standpoint of the present study are those who have taken iodine for a prolonged period of time and have come to operation after they have escaped from its benefit. Microscopical examination of these specimens shows a maximum effect of iodine. The cells are often degenerated, exfoliated and vacuolated. Clinically, however, the patients at the time of operation are often extremely toxic and represent a considerable surgical risk. Figure 7 (high

power) is from a patient who took iodine continuously for eighteen months. During her pre-operative hospitalization the basal

acini and mechanically compresses the lining cells, thus reducing their secretory power. Less thyroxin is produced, and

FIG. 5. Same animal after feeding thyroid extract four weeks; high power.
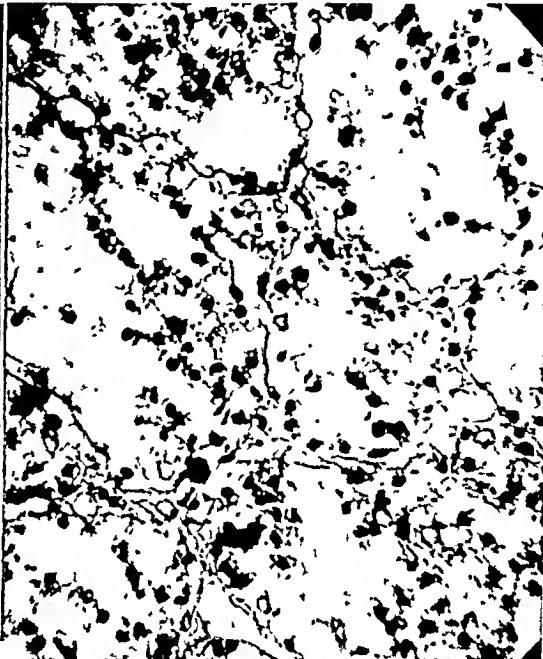
FIG. 6. Same animal after a rest period of three months, high power. Previous to this photomicrograph being taken, this animal had been receiving thyroid extract for four weeks and iodine for six weeks.

rate dropped only 11 points. At the time of operation, she was considered a serious risk, although the section shows a maximum effect of iodine.

If the section from this patient, who took iodine for several months, is examined carefully (Fig. 7), a striking resemblance to the section taken from a dog after prolonged iodine and thyroid medication is seen (Fig. 6). It would seem that prolonged iodine administration in these patients has produced a stage of exhaustion in the gland similar to that produced in the experimental animal. This histological picture is interpreted by the pathologist as a "maximum effect of iodine," but the clinical status of the patient is that of severe and active hyperthyroidism.

Consideration of the facts here presented is, I believe, sufficient basis for a theory to explain the action of iodine on the toxic goiter. When iodine is first given the cells are stimulated to secrete an excessive amount of colloid. This colloid fills the

the patient shows clinical improvement. Gradually the cells adjust themselves to the changed condition and resume their secretory power. The amount of thyroxin is thus again increased and the toxic symptoms increase proportionately. Further iodine assimilation continues to stimulate the colloid producing function of the cells, but since excessive colloid production is an abnormal function to which the cells are not accustomed, they become exhausted, can no longer produce colloid, and on continual iodine stimulation they degenerate. However, even in the stage of exhaustion, they are still quite capable of carrying out their pathological function, that is, production of excessive amounts of thyroxin. The microscopical picture, which is usually interpreted as a specific effect of iodine on the thyrotoxic-producing properties of the cells, is in reality the effect of prolonged and excessive colloid production.

It is an interesting coincidence that Decourcy[2] from clinical observations has arrived at the same conclusion regarding the effect of iodine as is here presented.

CONCLUSIONS

1. In the experimental animal iodine stimulates the cells to produce colloid.

2. Colloid retention compresses and flattens the cells of the acini.

3. The same effect occurs from iodine administration in the presence of experimental hyperthyroidism.

4. Prolonged iodine administration to a hyperthyroid animal produces a stage of exhaustion in the gland.

5. The effect of iodine on the normal gland is similar to that in the animal.

6. The effect of iodine on the hyperplastic toxic goiter is similar to that obtained in the normal gland of the dog.

7. After prolonged administration of iodine (three to twelve months) to the patient with hyperplastic toxic goiter a stage of exhaustion is noted. This is similar to that produced in the animal by prolonged feeding with thyroid extract and iodine.

8. The clinical status of the patient is not proportionate to the histological picture when iodine has been taken for a prolonged period.

9. A theory to explain the action of iodine in the patient suffering with hyperthyroidism is presented.
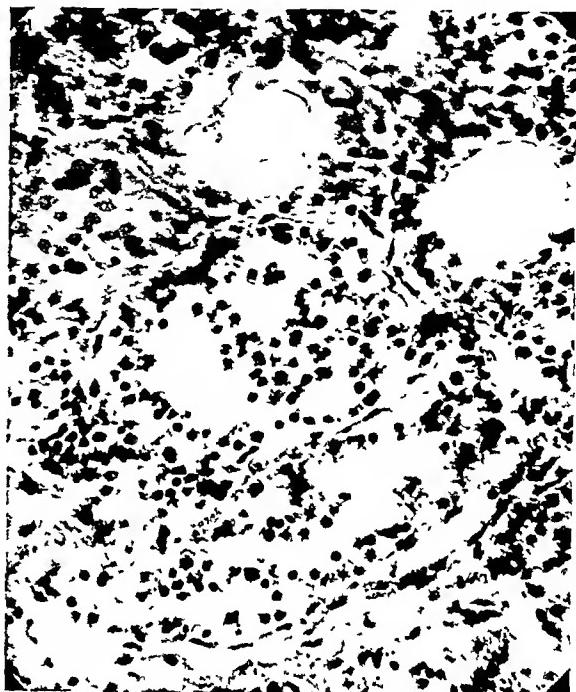

FIG. 7. Effect of prolonged iodine administration on hyperplastic toxic goiter; high power.

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ARTERIAL EMBOLECTOMY*

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PERHAPS no procedure in the realm of vascular surgery has such brilliant possibilities as the early removal of an embolus lodged in a large artery. At first glance it might seem surprising that the literature of the past three decades contains so few references to such attempts, successful or otherwise. The explanation lies in the fact that the general practitioner almost invariably sees the case first and either does not recognize the early symptoms and thus fails to diagnose embolism or is not acquainted with the potentialities of early surgery.

In 1895 Ssabanejew[14] first attempted to remove an obstructing arterial embolus which he expected to find in the femoral artery of an extremity threatened with gangrene. He failed to locate the embolus. Subsequently, Moynihan,[11] Stewart,[15] Doberauer,[3] Trendelenburg,[16] Proust,[13] Schiassi and Murphy,[12] Carrell and Leriche,[2] performed arterial embolectomy but none was successful in re-establishing the circulation.

In 1911 Lahey[8] successfully removed an embolus from the femoral artery six hours after it obstructed the circulation. In the following year Key[5] of Stockholm also successfully removed an embolus of the femoral artery. In 1922 he published a review of 51 other cases from the literature[6] and his own experience with embolectomy ten times in 9 patients. In 8 of his 10 cases the emboli were located in the lower extremity and the other 2 were in the upper. The result was good in 6 instances. His publication, pointing the way to a broader field of usefulness, proved to be a great stimulus to such surgery.

It is estimated that less than 150 cases of embolectomy have been reported in the literature. Of this number 95 were performed in Sweden from 1912 to 1925, inclusive. In this series there were 17 operations in 15 patients by Key. Less than 20 cases have been reported from the United States, Canada and England. Since the publication of Key's paper there has been a steady increase in the number of cases reported outside the Scandinavian literature.

If an embolus is not removed soon after its lodgment in a vessel, it usually grows by secondary thrombosis. There is great variation in the lapse of time before thrombosis occurs. It may be present two hours after obstruction. Lindberg[9] reported femoral artery embolectomy twelve hours after obstruction at which a secondary thrombus 86 cm. long was found. Ipsen[4] removed an embolus two days after obstruction in which case there was no sign of secondary thrombosis. Such thrombosis increases the danger to the extremity. If the embolus is so shaped that it does not completely occlude the vessel when it is obstructed, thrombosis completes the ischemia. The peripheral thrombus formation diminishes or prevents the circulation through collaterals, thus making the prognosis still poorer.

Early recognition of the obstruction is of the utmost importance if favorable operative results are to be obtained, because as soon as the obstruction occurs secondary thrombosis may begin and the chances for the re-establishment of flow diminishes as time elapses. While Key[7] recently reported a successful result following axillary embolectomy forty-eight hours after occurrence of obstruction, and Lian and Maure[10] record one after twenty-nine hours' duration, an analysis of the result in a large number of cases strongly suggests the necessity of early recognition and intervention for successful outcome.

Emboli may arise from the heart, the

pulmonary veins, the systemic veins or the arterial tree trunk. Willius[17] states that embolism of cardiac origin occurs in about 25 per cent of all patients dying of cardiac disease. No form of heart disease is free from the danger of embolism although the tendency is increased in valvular disease, particularly in mitral stenosis. Mural auricular thrombosis occurs frequently in myocarditis with auricular fibrillation. Thrombus formation is dependent on platelet accumulation. The latter always occurs with circulatory stasis. In myocarditis with auricular fibrillation the auricles fail to empty themselves. The consequent stasis favors the formation of thrombi. Thrombosis may be found in both sides of the heart and thus give rise to simultaneous pulmonary and systemic circulatory embolism with resultant infarction of the lung and gangrene of an extremity.

Embolism has frequently been reported as following an operation or parturition or complicating a septic process in all three instances in the absence of any demonstrable heart or gross vascular lesion. In the first two the process is not multiple.

The incidence of embolism is more frequent than the reported cases would suggest. In the examination of over 6000 necropsy records at Rik's Hospital, Oslo, Bull[1] found embolism of the vessels in the lower extremities 14 times and in the upper once. In 7 of the 15 cases there was no gangrene and in 13 instances the thrombus was in the cardiac chambers whereas in the remaining 2 it was in the aorta.

When a fragment of a cardiac valve or vegetation or a cardiac thrombus becomes detached, its course does not follow any definite order. It would seem that the larger the foreign body the more likelihood of its reaching the lower extremities. No matter which route it travels, however, it ultimately reaches a point in the lumen which is narrow enough to prevent further progress. This usually occurs at a bifurcation of the vessel or at a point where a large branch is given off. Here it lodges. If it remains long enough its shape is molded to that of the vessel at the point of lodgment, primarily by pressure and secondarily by the ensuing thrombosis so that it may become saddle-shaped or pronged. The projection of the embolus from the main vessel into both arms at a bifurcation or into a large branch and the production of distal secondary thrombi interfere with the establishment of collateral circulation. Thus there is a greater possibility of the development of gangrene.

SYMPTOMS

Invariably, the sudden blockade in a large vessel is heralded by a sudden, severe, stabbing pain in the affected extremity. This pain gradually diminishes in intensity as the nutrition of the extremity is progressively lessened. The other characteristic subjective symptoms are sensations of cold and numbness and disturbance of sensation. Objectively it is noted that the skin changes color, becomes marble-white, blotchy, ashen and later lividly mottled. Motility of the extremity is restricted and may be entirely lost. The temperature of the limb is lowered, the skin and tendon reflexes are lost and there is an absence of pulsation. These are all symptoms of ischemia. Since embolism often occurs in severe cardiac disease, an additional train of symptoms of prostration, tachycardia and dyspnea may be precipitated by the pressure of blood diverted from an extremity by an impassable barrier, and exerted on an already oppressed heart.

Key states that the marked circulatory disturbances may be preceded by prodromal symptoms due to lodgment of small emboli. In cases of femoral embolism before the development of ischemia there may be pain in both legs; but after the appearance of the circulatory disturbance the pain is definitely confined to one extremity. This is explained by the assumption that at the time of pain in both legs the embolism is straddling the aorta and momentarily partially obstructing both iliac arteries.

DIAGNOSIS

A history of sudden onset of pain, coldness, numbness, blanching, lowered temperature and absence of arterial pulsation in an extremity especially if the patient has endocardial or myocardial disease clinches the diagnosis of embolism. The condition must be differentiated from venous thrombosis in which the pain is distributed along the course of the veins, the extremity is warm, cyanotic and swollen, the sensation is not impaired and arterial pulsation is present. Arteriosclerosis with circulatory disturbance is easily distinguished by the gradual onset, slow extension of the process and recognizable vascular changes throughout the body. Endarteritiis obliterans offers no difficulties in the differential diagnosis. There should be no difficulty in recognizing embolism in a large vessel if the obstruction is complete.

LOCALIZATION

The localization of the embolus is frequently not difficult. Where the obstruction occurs in a vessel in an extremity, the point at which pulsations cease is often ascertainable. In thin individuals it may even be possible to feel a slight enlargement and an increased resistance at the site of obstruction. The height of the blanched, mottled or cyanotic area is in itself not a good indication of the level of the obstructing body because of the influence of collateral circulation. It must be remembered, however, that the embolus is always situated centrally to the upper limits of the ischemic area. The embolus usually lodges at a bifurcation or big branching. Thus in most cases operated on the obstruction was found at the origin of the common iliac, common femoral, popliteal arteries or in the axillary where the subscapular branches off. Difficulties may present themselves in cases of secondary thrombosis, multiple embolism or bifurcation lodgment with complete block of one side and incomplete block of the other giving rise to confusing symptoms unless such possibility is considered. However, when the location is in question, there should be no hesitation over an exploratory incision.

PROGNOSIS

The ultimate result is dependent among other factors upon the underlying cause. Many publications of successful embolectomies with complete restoration of the circulation are accompanied by a report of the patient's early death subsequently from other emboli, cardiac failure, sepsis, etc. It is significant that the best ultimate results are attainable in embolism following operative procedures or parturition where there are no demonstrable cardiac lesions. Here, there are usually no secondary embolic formations to influence the recovery. Naturally the prognosis depends in a large measure on early diagnosis and treatment, but a very important part is played by the localization of the embolus. Thus in operations for the removal of an embolus from the aorta at its bifurcation especially if the embolus be saddled so that both common iliacs be occluded, the prognosis is much more grave than in embolectomy in the femoral or popliteal arteries. A much larger portion of the vascular system has been thrown out of the circulation by occlusion at the aortic site and this in itself exerts a deleterious influence on the heart. In a series of cases tabulated by Key, in which operation was performed in the first ten hours after obstruction, of the axillary and brachial emboli three-fourths were successful, of the femoral one-half were successful, of the iliac one-third were successful and of the aortic one-seventh were successful. These same cases were tabulated according to lapse of time between occlusion and operation. Of 75 operated within ten hours 34 were cured. Of 14 operated between ten and fifteen hours after occlusion, 3 got well. Of 10 cases in which from fifteen to twenty hours elapsed before operation, 1 was successful. Of 13 cases in which the time interval was between twenty and thirty hours, 2 were cured. Of 9 cases operated on between thirty and forty-eight

hours after occlusion, 1 was successful. There were no successful cases in which occlusion lasted more than forty-eight hours.

TREATMENT

This resolves itself into two kinds. Where the obstruction is located in a small vessel and there is little likelihood of resultant gangrene, or where the patient's general condition precludes operative interference, non-surgical methods consisting of the application of heat and vigorous massage may be employed. In the former variety the success of such measures is almost certain; but in the latter, if the embolus is lodged in a vessel of fair size, the chances of success are few. Such cases develop gangrene more readily than if the vessel were occluded at the same point by ligature because with embolism there is a greater tendency toward secondary thrombosis, which, as previously stated, diminishes the possibility of the development of collateral circulation.

Where the embolus is lodged in a large vessel and gangrene impends and with the patient's condition permitting, the ideal form of treatment is embolectomy performed as soon as possible after the onset of obstruction. Delay is always contraindicated because the nutrition and vitality of the extremity become progressively poorer and the likelihood of thrombosis increases with the continued interruption of the circulation. If the case is seen late, embolectomy is still the operation of choice, because, even though the gangrenous processes have already begun, removal of the obstruction tends to restrict the spread of tissue necrosis.

It has been shown that the maintenance of the vitality of tissues to which the main arterial supply has been interrupted by ligation can be augmented by simultaneous ligation of the accompanying vein. The rationale behind the procedure is that the capillary pressure is thereby raised. This operation should not be performed where there is reasonable assurance of the success of embolectomy, namely, where the embolus has been removed early before thrombosis has occurred, where free bleeding follows the removal and forceful pulsations in the extremity are felt after the vessel is sutured. When, however, the removal of the embolus is accomplished in the presence of beginning gangrene, the operation having been undertaken with the hope of limiting the process, ligation of the accompanying vein is advisable.

OPERATION

The ideal form of anesthesia is spinal block. It is particularly valuable in cardiac cases because of its tendency to lower the blood pressure markedly. This diminishes the burden of an already overloaded and incompetent heart. It gives maximal relaxation which is exceedingly valuable for a direct approach in obese individuals in whom the embolus is lodged in the aorta, at the bifurcation or in an iliac vessel. It is applicable for attacking the vessels of the upper extremity as well as those of the lower.

An incision is made as near the site of embolism as possible. The vessel is exposed and the embolus located. It has been stated that if possible the arteriotomy should be done above the site of obstruction. To us it seems more logical to open the vessel below. It is far easier to prevent the peripheral distribution of fragments occasionally produced during the dislodgment and removal of the embolus. Secondary thrombosis is more easily recognized and treated, the restoration of free flow of blood after removal of the embolus is now not a matter of conjecture, because with the incision below the obstruction site free bleeding from the arteriotomy is plainly evident if the obstruction is removed, or there is not free bleeding if the removal is incomplete. The artery is therefore incised longitudinally below the embolus and the latter is extracted. Its removal is facilitated by gentle massage. If free bleeding follows, the vessel should be compressed by a soft nose clamp and the arteriotomy wound sutured.

The sutures of ooo silk doubled, threaded on a No. 12 sewing needle, may be interrupted or continuous. We prefer a con-


FIG. 1. Closure of arteriotomy wound by continuous suture.

tinuous suture placed as shown in the accompanying illustration. It gives better occlusion. After the closure, the clamp should be removed and distal pulsations sought for. If a pulse is not felt, the vessel should be opened at a lower level and the occluding clot removed so that free bleeding is obtained. It may be necessary to wash out the clot between the two arteriotomy wounds with saline.

If a direct approach to the embolus is not made, it may still be removed through an arteriotomy some distance distally to the obstruction site by probing and massage or the use of a long alligator forceps. Cases are recorded in which emboli have been successfully removed by the indirect method in some instances from the aorta by a femoral artery approach. The iliac arteries and the aorta may be approached either transperitoneally or retroperitoneally if the direct method is used.

When a saddle embolus at the aortic bifurcation is removed through a one-sided approach the other iliac or femoral should also be opened to insure freedom of that side from thrombosis as a result of partial vascular occlusion.

If re-establishment of the circulation is not possible, it is advisable to ligate the accompanying vein at the site of arterial obstruction or even centrally to that point.

This is of material value in aiding the re-establishment of collateral circulation and limiting the amount of gangrene.

CASE REPORT

CASE I. A. S., a female, aged fifty-three, was seen in consultation with Dr. A. Stone on March 22, 1928 at 4:30 P.M. for embolism of the axillary artery.

The patient had been sick for several years with cardiac disease diagnosed as endocarditis with mitral stenosis, myocarditis with attacks of fibrillation, bronchitis and emphysema. She had decompensated on several occasions, and had been taking digitalis for the previous year.

Two weeks before admission to the hospital she had been orthopneic, and had been fibrillating but improved on digitalis. A week later she suddenly became comatose for a few hours and when she regained consciousness it was noted that she was speechless and had a left hemiplegia. For seven days she showed improvement steadily until at 3 P.M. on March 22, she suddenly felt a severe pain in the left upper extremity from the shoulder down into the hand. The extremity became numb and cold. Dr. Stone who saw her shortly after the onset of symptoms diagnosed embolism of the axillary artery on the history and the physical findings of pallor of the extremity, absence of pulsation of the radial and brachial artery and presence of pulsation in the left subclavian artery. She was operated on at 7 P.M. under spinal anesthesia. The axillary artery was exposed and the embolus located at about the middle third of the artery. A longitudinal incision was made about 1 cm. below the embolus. A thrombus about 10 cm. in length was removed from the peripheral portion of the vessel. The embolus was extracted with a pair of fine forceps. This was followed by a gush of blood. The bleeding was controlled by a soft-bladed clamp and the arteriotomy wound closed by continuous suture of doubled ooo silk. The artery clamp was removed and radial pulsations sought for but none was felt. The artery was opened about 10 cm. peripherally to the original wound. Free bleeding was encountered from the central end. Another piece of thrombus about 6 cm. was removed from the distal portion of the vessel, the second arteriotomy closed in a similar manner and then it was found that there were distinct and forceful pulsations in the radial artery of the

extremity. The wound was rapidly closed with a continuous silk suture. On March 23 1928, the day after operation, there was cyanosis of the lips, finger tips and toes. She was dyspneic and orthopneic. The tongue was deviated to the right, the veins of the neck pulsated markedly and filled from below upward. The heart was fibrillating, the ventricular rate being 128 while the pulse rate was 76. The apex was in the 5th interspace 11½ cm. to the left of the midline. There was a loud apical systolic murmur transmitted to the left. There were congestive râles at both bases. The abdomen was soft; there were no masses palpable. The left upper extremity was not edematous, the finger tips were somewhat cyanotic, but pulsations were distinctly palpable in the radial artery at the wrist although they were slightly weaker than those in the right.

On March 25, she complained of sudden pain in the left arm near the shoulder and almost simultaneously of a severe pain in the abdomen. The latter was excruciating and was rapidly followed by marked rigidity and distention. There was also a severe pain in the left lower extremity. The latter quickly became cyanotic as did also the abdominal wall. Pulsations in the left radial ceased. None was felt in the left femoral, popliteal or dorsalis pedis arteries. She voided only 1½ oz. of urine in twenty-four hours. The distention became worse, vomiting became almost continuous, there were bloody stools, the pulse became rapidly weaker and on March 26 she died. Apparently she had a shower of emboli which lodged in the left axillary, left renal and left femoral vessels, in the aorta and perhaps the mesenteric vessels also. Unfortunately, an autopsy was not obtainable.

CASE II. E. W., a female aged fifty-two, was admitted to the hospital May 3, 1928 complaining of sudden severe pain in left leg and thigh of eight hours' duration. She also complained of coldness of the extremity and inability to perceive touch. The extremity had a mottled cyanotic appearance extending from the toes up to about the level of the condyles of the femur. No pulsation was felt in the left dorsalis pedis, popliteal or femoral. She had been treated for more than a year for arteriosclerosis and myocarditis and during that time auricular fibrillation was a prominent feature of her clinical picture.

The patient's general condition was very poor. She was very obese, dyspneic, fibrillating, cyanotic and in all a poor subject for operative treatment. Nevertheless, under spinal anesthesia on a diagnosis of embolism of the left iliac artery, the upper part of the femoral artery was exposed by a longitudinal incision at the base of Scarpa's triangle. The artery was incised and a thrombus 20 cm. long was removed from the distal portion. The proximal portion was probed and a small thrombus removed behind which was an embolus. This could not be reached through the femoral arteriotomy so the latter was closed by the method described in the previous case report and the iliac artery exposed by enlarging the incision upward on the abdomen, incising the transversalis fascia above Poupart's ligament and pushing back the peritoneum. The iliac was incised and probed and an embolus removed from a point about 8 cm. centrally to the arterial incision. Free bleeding could not be produced in spite of careful probing. The bleeding which followed the removal of the embolus was slight, was not remittent in character and was under slight pressure. Apparently there was centripetal thrombosis. By this time the patient's condition was so poor as to contraindicate a continuation of the operative procedure, so the artery was sutured, the femoral vein ligated at Poupart's ligament, and the wound rapidly closed.

The following day the foot and leg were cold, cyanosed and numb. The patient was very dyspneic and cyanotic, the heart rate was greatly accelerated, the pulse deficit was 62 and in general she was very much worse. There was a tendency toward limitation of the mottling and cyanosis of the extremity by an irregular circular line at about the level of the condyles of the femur. The other extremity appeared and felt normal. Here cardiac condition rapidly grew worse and on the morning of the second day she died. At this time the extremity showed no further progress toward gangrene.

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BURSITIS OF THE FOOT
A NEGLECTED CAUSE OF DISABILITY*

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A TYPE of foot pain which has received little attention from the writers of textbooks on orthopedic surgery is that due to irritation of one or more of the numerous bursae to be found in the foot. These structures occur as adventitious formations such as I have found in eleven different areas of the foot or as constant sacs, ten of which are known, and, although they are demonstrable on the cadaver, they are given scant consideration in current works on anatomy. The literature on the subject is extremely meager. Except for two papers by Arthur E. Hertzler of Halstead, Kansas, there are no contributions in English.

My own interest in the subject was awakened several years ago when, in operating for a calcaneal spur, I encountered a well-formed bursa lying between the inferior surface of the os calcis and the skin. It occurred to me at the time that the symptoms of painful heel were more likely due to bursitis than to pressure of the exostosis on the soft tissues under the heel. Since then I have observed painful heels without spurs and spurs without painful heels, which suggests that the importance of the spur as a pain-producing factor has been overestimated. In all subsequent spur operations I have looked for a bursa, which, as is rather generally known, frequently develops in this situation. If found, it was excised, and if not discovered, a thin layer of the subcutaneous tissue on the bottom of the heel was removed, experience having taught me that adventitious bursae not always capable of demonstration occur in the superficial fascia of the sole in this and various other situations.

A study of the histology of this subcutaneous pad will explain why this is so.

The individual masses of fat are surrounded by delicate stromata of connective tissue and as these are grouped together membranous partitions are formed of two or more loosely connected layers between which spaces are seen from time to time which act as lymph reservoirs. Now, adopting the description of Clarkson, a well known English histologist, a bursa is nothing more than an enormously distended lymph space, the cells of whose connective tissue walls have through constant friction assumed the function of secreting a fluid more viscous than lymph which serves as a friction-reducing medium between two gliding surfaces. It is conceivable, therefore, that sacs may form in the subcutaneous tissue with walls not sufficiently dense to be recognized at operation, but which, nevertheless, possess when irritated the pain-producing characteristics of inflamed bursae elsewhere.

Appreciating the possibilities of bursal formations in the superficial fascia of the sole, I have on several occasions operated for what appeared clinically to be a bursitis in this region notwithstanding that the patient's complaints were those of "painful arches" which had been unrelieved by properly fitted metal plates. Although in only two instances have I been able to demonstrate well formed sacs, in the other cases portions of the subcutaneous tissue corresponding to areas of tenderness found at examination were excised. Complete relief from pain followed to the operations and the metal supports were discarded.

Hertzler, whose interest in bursae of the feet dates back more than twenty years, finds the subcalcaneal bursa relatively constant and, likewise, one designated as the anterior calcaneal bursa which lies

between the origin of the abductor hallucis and the tendons of the long flexors as they pass from under the sustenaculum tali. He

FIG. 1.   FIG. 2.

FIG. 1. Bursae of foot, dorsal view. Constant sacs indicated by solid lines; occasional formations by broken lines. Straight line indicates incision to reach metatarso-phalangeal bursae.

FIG. 2. Bursae of foot, plantar view. Constant sacs indicated by solid lines; occasional formation by broken lines.

points out also that bursae lying over each of the metatarsophalangeal joints are responsible for anterior arch pain and he records many cures of so-called metatarsalgia by the simple procedure of destroying these bursae with a curette.

The symptoms which accompany inflammation of the bursae of the foot are not always localized, except those incident to subcalcaneal bursitis where the usual picture of "painful heel" occurs and those accompanying inflammation of the bursae adjacent to the lower extremity of the tendo Achillis. On several occasions I have operated on cases of painful heel where no spur appeared in the roentgenogram and no distinct sac was encountered at the operation. However, removal of some of the superficial fascia covering the tuberosity of the os calcis resulted in complete relief of pain just as it did in the cases of tenderness under the arch previously cited.

The assumption is reasonable that in all these instances I was dealing with what may properly be termed occult bursae, the origin of which has been explained. Irritation of the anterior calcaneal bursa which lies between the origin of the abductor hallucis and the tendons of the long flexors and is a constant structure gives rise to symptoms which are usually interpreted as due to arch strain. One of my patients accumulated a useless collection of foot plates prescribed by various orthopedic surgeons during a period of two years, at the end of which time he was suffering so much that he contemplated giving up his position. Careful examination elicited a circumscribed area of acute tenderness corresponding to the anterior calcaneal bursa. As the man desired to avoid operation the painful tissues were compressed by an adhesive strapping, he was put to bed for ten days and continuous wet dressings were applied. He discarded his plates and resumed his work as a salesman at the end of two weeks, free from pain for the first time in two years. Notwithstanding the happy result in this case the patient was warned that excessive use of his feet may cause a recurrence of symptoms and necessitate an operation for obliteration of the bursae. This case illustrates a point in treatment. Acute cases may be relieved by the same measures which would be used in bursitis appearing in more usual regions, but in the chronic cases I believe it is better to operate without delay as the period of postoperative disability is short and the risk almost nil.

Another case illustrating the varied distribution of these bursae is that of a business woman whose pain was referred directly to the arch of one foot and was increased by walking and standing. In spite of treatment the disability persisted to a degree which threatened her business usefulness. Careful examination disclosed that her discomfort was due to inflammation of a bursa near the insertion of the tendon of the tibialis anterior. Compression of the affected area and rest gave her

temporary relief and the bursa will later be obliterated by operation if the symptoms recur.

Hertzler suggests. There are instances, however, where the symptoms of metatarsalgia are not accompanied by evidence

FIG. 3. Bursae of foot, medial views. Constant sacs indicated by solid lines; occasional formation by broken lines.

FIG. 4. Bursae of foot, lateral view. Constant sacs indicated by solid lines; occasional formations by broken lines.

In addition to the bursae already enumerated there is a sac of considerable size lying between the short flexors of the toes and the flexor accessorius. Inflammation of this bursa produces symptoms referable to the arch, underneath which it lies, and as friction upon it is increased if the arch is depressed, it is a very likely cause of flatfoot discomfort which is only partially relieved by metal supports. Obliteration of the bursa may be accomplished by an incision through the flexor digitorum brevis, care being taken to avoid the plantar artery and the lateral branch of the plantar nerve which rest upon the superior surface of this muscle, separated from it by the bursa.

If I cannot agree with Hertzler that all cases of metatarsalgia are due to bursitis I am sure that many of them can be thus explained. In some cases deep palpation on each side of the metatarsal heads will elicit the sharp pain characteristic of bursitis. In others, similar areas of tenderness may be noted just posterior to the under surface of the distal extremities of these bones. Some cases are readily cured by curettage of the irritated tissues, as

of bursitis and one would hesitate to advise operation without more definite information of the causa vera of the disability.

Painful bursae of the adventitious type, the symptoms of which I have relieved by surgical measures, have been found just below and anterior to the malleoli, over the posterior aspect of the calcaneum below the insertion of the tendo Achillis, over the bases of the 5th metatarsal bones, over the heads of these bones on the lateral aspect, and in various situations on the dorsum of the foot where friction of a shoe or other forms of trauma have produced definite sacs with the usual symptoms of pain due to constant friction.

In my investigation of bursitis of the foot I have been impressed by the fact that in certain individuals the areolar tissue seems unusually susceptible to the formation of multiple painful bursae. In the case of a mail carrier four bursae were obliterated in one foot. The other foot was normal. In a man sixty years of age four bursae were obliterated in each foot. In the case of a waiter four bursae were obliterated in one foot and two in the opposite foot. He left the hospital entirely

comfortable but two months later was readmitted at his own request to have four other bursae operated on which were not

FIG. 5 Cross section of foot anterior to ankle joint showing bursa between flexor brevis digitorum and flexor accessorius musceles (intermusecular) and bursa between head of abductor hallucis musele and tendon of long flexors (anterior ealeaneal).

painful when he was originally admitted. In several other cases there were multiple painful bursae and in only a few were there single lesions.

In conclusion let me remind you that occult bursae may form in areolar tissue wherever persistent friction creates a demand for an anti-friction medium, and that repeated trauma may produce inflammation of the bursal walls with the usual discomfort of such a condition.

Symptoms are not always confined to the area of irritation. Pain may be described as a moderate discomfort or it may be sharply acute on motion and may be referred to the longitudinal arch, the dorsum of the foot, the ankle or even the leg. It may simulate strain due to faulty statics and therefore mislead the surgeon who fails to make a painstaking examination.

The diagnosis will rest chiefly upon the discovery of circumscribed areas of tenderness which cannot be otherwise explained.


FIG. 6   Metatarso-phalangeal bursae. (Spalteholz).

When the subcalcaneal, the anterior calcaneal or the metatarsophalangeal bursae are inflamed there will be no difficulty in locating the tender points and thus arriving at a diagnosis. It is possible however, to confuse the symptoms of inflammation of adventitious bursae in the superficial fascia of the sole with those of the constant sac lying between the flexor brevis digitorum and the flexor accessorius. Differentiation here will depend upon the

amount of pressure required to elicit pain and the patient's impression as to whether the discomfort is superficial or deep.

The treatment for these conditions is the same as for bursitis elsewhere. Complete rest with the compression of the affected part will frequently clear up the situation. Where such measures fail or where the time element is a factor it is more logical to obliterate the inflamed sac surgically and thus effect a permanent cure.

DISCUSSION

DR. HAROLD D. CORBUSIER. Dr. Roberts brings up a subject which has been very much neglected, even in the anatomies. Neither Gray nor Morris gives a sufficiently full description of bursae. I operated on a case the other day removing two exostoses from the posterior aspect of the os calcis and discovered a large bursa, which I excised. The patient is doing well and walks without pain, whereas before she could not go anywhere without discomfort. I have found the bursae deep in a plantar ligament, in a case associated with flat foot; and have also found these bursae in other conditions of weak feet, not with actual flattening of the arch but with symptoms occasioned by wearing metal arches. In my opinion many of these bursae are caused by metal arch supporters which I do not use as I believe they are not necessary in the vast majority of cases. Results can be obtained with hot saline baths, massage and diathermy in the absorption of some of these bursae, but these are those about the os calcis which often require operation.

DR. SIGMUND EPSTEIN. Since Baer wrote a paper on the subject in 1906 I have been interested in cases of painful heels. I have seen a number of them get well by simply resting in bed. But in chronically tender painful heels I have rarely seen a well formed bursa at operation. When there is a bursa the injection of alcohol is usually sufficient to obliterate the sac, but if they have to be operated on they should not receive merely superficial attention; they should be trephined in addition to curetting and removal of a disc of bone that includes the tuberosities of the os calcis.

DR. DEXTER D. ASHLEY. I have seen only a few bursae; I formerly always operated on them, but now I operate on very few. I believe that they are preceded by irritation and if you can remove this, nature will do a great deal to cure the patient. If the bursa is infected or there is exostosis, that is a different thing. Very often bursitis will clear up spontaneously; I know of one such case, an old man with an enormous bursa of the knee who refused operation and lived for twenty years longer during which the bursa disappeared.

DR. ROBERTS (closing the discussion). It is true that painful spots might be due to irritation of the nerve. Any irritation of the areolar tissue may produce bursae the walls of which are so delicate that you cannot see them, or they may be of such dense tissue that you cannot tear them. If we remember that a bursa is nothing more than an enormously distended lymph space it is easy to understand that we can have these bursa from microscopic size up to the size of a cherry or larger. No doubt rest will cure some cases of bursitis if enough time is taken, but if you depend on rest to get rid of the symptoms you will subtract a lot of time from the patient's life, and when he gets about again the bursa may re-form. That is a common history of the metatarsal cases. Rest is very good; I have used it a number of times, but personally I think operation is the thing unless one can effect a cure in a week or so with complete rest. Dr. Epstein spoke of taking off part of the surface of the os calcis. One can do that and still not get rid of the pain. We had a case that was thought to be periostitis of the os calcis and someone had chiseled off the surface of the os calcis; the patient had subsequently been well for two weeks but after that the pain recurred. We laid back the under surface of the heel and found a bursa. I took out a section of the superficial fascia and the patient has been well ever since.

ELECTRICAL TREATMENT OF SUBDELTOID BURSITIS*

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OLDER writers have said that inflammation of the subdeltoid bursa is a very rare condition and some of them have even gone so far as to state that it is generally tuberculous. Since 1915 Brickner,[1] Fields,[2] Montgomery,[3] and Moschcowitz[4] have inquired into the true affection of the subdeltoid bursa and have published articles upon this condition. The largest number of cases was reported by Brickner.

Modern refinements in diagnosis have disclosed that there are even more cases of inflammation of the subdeltoid bursa than was generally suspected, and it is the experience of those practicing in New York hospitals that almost 50 per cent of cases of pain on motion, confined to the shoulder, are due to subdeltoid bursitis.

The diagnoses frequently made for this condition are rheumatism, arthritis, neuritis, and myositis of the shoulder. A few notes on differential diagnosis many be appropriate, and the writer will only refer to the important points without entering into details. Rheumatism may generally be ruled out because of lack of symptoms in other parts of the body. Arthritis may be differentiated by the pain being caused by all motions of the joint. Neuritis affecting only the shoulder joint has a history of direct trauma to the shoulder joint, and

myositis has the same kind of history. It must be remembered, however, that some long-standing cases of bursitis are complicated by the symptoms of what is frequently called brachial neuritis. Cases of neuritis that have been successfully treated and still retain pain in the shoulder should always be suspected of being a secondary neuritis caused by a long-standing chronic bursitis.

A positive diagnosis of subdeltoid bursitis may be arrived at by a few important points. First, there is an absence of muscular spasm. Forward and backward motions of the arm are not very painful, but abduction of the arm becomes increasingly painful until the arm gets to the horizontal when it is claimed the bursa slips down into the glenoid fossa and the arm can be moved in all directions above the horizontal without pain. When, however, the arm is allowed to drop again it must go through the painful part of the arc, and the bursa is again snapped out of the shoulder joint. Another indicative physical finding is that most cases evidence great pain on internal rotation of the arm. Some orthopedic writers refer to a swelling of the shoulder immediately over the bursa; but this is really a very infrequent symptom. On the other hand, long-standing chronic cases will often show atrophy of the deltoid muscle and anesthesia of the overlying skin. It is extremely important to remember that chronic cases can exhibit a superficial anesthesia, because in administering diathermy patients may often be so insensible to the heat being applied to the skin that serious burns may result.

As regards the etiology, practically all writers are agreed that focal infection does not play any part in this condition. On the

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* Read before the Second International Congress of Radiology, Stockholm, Sweden, July 23–27, 1928.

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other hand, all agree that the condition is always caused by trauma, either direct, indirect or thermal. Direct trauma, of course, comprises such cases as a man falling from a horse or being struck on the shoulder by some object. Experience has shown that indirect trauma, such as carrying a heavy object for a long time and excessive, unusual exercise of the arm, has caused some cases. But in the cases upon which this paper is based, by far the greatest number of patients have noted an onset of symptoms after a thermal trauma, such as exposure to cold. Infected bursae have been mentioned by some authors but none has ever been described.

The symptom that patients complain of is usually inability to lie on the shoulder or on the opposite shoulder. They notice pain on all lateral motions except when the arm is raised by being brought across the chest to the horizontal. They are then able to use the hand to fix the hair and to make such motions above the shoulder. They also prefer to support the arm against the chest, taking the pull of its weight off the shoulder. The only comfortable position at night is lying on the back with a small pillow raising the shoulder. It is a very constant unexplained symptom amongst patients with this condition that they have pain just below the deltoid insertion and also on the extensor surface of the wrist. If the condition is of a few weeks' duration, the patient may also have pain in the scapular region due to a general spasm of the shoulder muscles.

When chronic cases come for treatment and it is deemed necessary to confirm the diagnosis by roentgen ray, it is of extreme importance that the patients be sent to a first-class roentgen-ray laboratory. Many cases of calcification in the region of the bursa are missed when the roentgenologist is not sufficiently experienced to get the arm in the correct position to assure disclosure of calcification. External rotation of the arm during roentgen-ray examination is necessary to reveal calcification.

The treatment of these conditions covers almost every conceivable idea about them. There are ardent believers in certain methods which are as ardently opposed by others interested in the treatment of bursitis. It should be stated that massage is useless, while exercise is helpful only to a very slight extent. Stretching of the joint is extremely painful and cannot be relied upon to produce any certain help. In most cases immobilization is not necessary. In the writer's opinion only cases of acute bursitis superimposed upon a known chronic bursitis with calcification require immobilization. Real acute cases are made comfortable by carrying the arm in a sling whereby the weight of the arm is lifted from the joint. This procedure, however, is merely for the patient's comfort and of no actual therapeutic value. Brickner has devised a very clever and efficient method of controlling the movements of the arm by fastening the elbow to the head of a bed with a towel; the patient being raised on pillows, as he gradually slips from the pillows, this procedure compels a painless abduction of the arm without causing acute muscular spasm. Until recently the only treatment for chronic subdeltoid bursitis, where calcification is revealed by roentgen-ray examination, has been an operation for the removal of the bursa. Some writers state that actual removal is impossible, while others think it is not a difficult operation. Nevertheless, operative treatment results in a disfiguring scar. The only cases in our experience in which operative treatment was preferable were those old chronic cases with an acute exacerbation. Within the past year, however, it has been found that complete immobility of the arm with the treatment described below has relieved patients of all pain and also brought about absorption of the calcification.

Before going into this particular electrical treatment, it is but fair to state that it has been actually noted that when roentgen film has been made of a shoulder which showed calcification, there has been a distinct relief of symptoms, undoubtedly

due to the roentgen ray passing through the shoulder. It has been claimed that some cases will clear up entirely, even those with

FIG. 1. Grounded autocondensation treatment. Patient sitting on autocondensation pad and connected in ordinary way. Operator grounds high-frequency current through her finger.

calcification, after being exposed to the roentgen alone. None of these cases has been actually reported but all writers claim to have seen this result.

Electricity as a means of treating these cases has been used for a number of years, and it must be admitted with somewhat unsuccessful results. Galvanism is still recommended by a few old-fashioned writers, who still believe that a galvanic current can affect tissues lying as deep as the subdeltoid bursa. Since the use of high-frequency electricity as diathermy has been recognized as a rational procedure, many have attempted to treat the subdeltoid bursa with diathermy, but the usual technique of placing an electrode in front and behind the shoulder joint has done nothing more than heat up that part of the body without producing any actual affect upon the subdeltoid bursa. Nagelschmidt recommends placing a small electrode over the bursa and a large one in the opposite axilla, but the size of this small electrode so limits the amount of current that can be given that the effects, if any, are quite negligible.

In 1922 the writer had for treatment a

particularly stubborn case with calcification for over three and a half years and almost entire immobility of the shoulder

FIG. 2. Static effluve treatment.

joint. The technique was evolved of placing the patient on an autocondensation pad and administering high-frequency electricity of such quantity that the meter read about 900 ma. This patient was anesthetic over the bursa and could not detect the heat when too great. The writer therefore decided that the best guide to dosage was to place his own finger over the bursa and ground the high-frequency current through the operator's finger. This was done and immediately the effect of this concentrated flow of high-frequency electricity through the small area covered by the finger directly over the bursa produced remarkable results. This technique was described in a series of case reports in 1922. It must not be supposed, however, that diathermy alone will cause the rapid disappearance of calcification or decrease all symptoms in acute cases.

Cooperman published a report of 12 cases which were treated with diathermy, medicinal means and immobilization with later passive manipulation, but his results were obtained very slowly.

Diathermy, we have reason to believe, creates congestion in the part to which it is administered, and this should never be considered sufficient treatment. It has never been proved that medication has any effect at all on these cases except to dull the

pain when appropriate drugs are used. Manipulation and stretching can have little, if any, effect upon these bursae which, lying upon the supraspinatus tendon, are only slightly affected by muscular motion. To increase the effectiveness of diathermy, it is quite necessary to use such a modality as static electricity, which, due to its decongesting action, will forcibly promote absorption of the fluid in an acute bursa and also promote absorption of calcification when present as a complication of chronic bursitis.

Brickner undoubtedly is correct (although all other writers on this subject do not agree with him) that the calcification is not in the bursa nor in the entire wall of the bursa, but lies more in the tendon of the supraspinatus muscle under the floor of the bursa. Nobody has ever reported finding actual salts of calcium in the bursa itself. Therefore, calcification is an associated condition undoubtedly brought about by the body as a means of protecting the tendon of the supraspinatus muscle from interference with its function because of the chronically inflamed bursa lying above

it. It does not take long for calcification to form, for in the series of cases treated by the writer one patient had an indirect trauma to the bursa five days before a roentgenogram was taken, when the calcification was revealed. This patient, a college professor who could be relied upon for his history, was positive that he had never had any trouble in that shoulder before. Inside of three weeks all calcification was absorbed, and, we hope, due to the treatment.

In conclusion, it can be stated from a personal experience with over 150 such cases, that the combination of general heat to the shoulder, as from an incandescent lamp, to increase the efficiency of the high frequency-current which is next administered as "grounded auto-condensation" and then followed by the application of the static current as an effluve, can be relied upon to relieve all forms of bursitis, either acute or chronic. Admitting that spontaneous absorption of calcification can take place, this method of treatment can also be relied upon to bring about an absorption of calcification in the region of the bursa.

CARTILAGE INJURIES

A CLINICAL STUDY*

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IN the July issue of the Journal of Bone and Joint Surgery for the Year 1926, under the title "Introductory Considerations," a few of the more practical anatomical, chemical and pathological aspects of cartilage injuries were considered. Following that discussion a few of the more frequent conditions involving cartilage may now be discussed. In the article mentioned this study was extended to include the fingers and wrist.

THE ELBOW

Inasmuch as there are no fibrocartilaginous structures within the elbow it would seem, at first thought, that this articulation should be omitted in a discussion dealing with injuries to cartilage. On the contrary, it is in this very location that we have our best opportunity for studying the early production of cartilage and the formation of bony proliferations. Most or at least many of our bad end-results in the treatment of fractures in or about the elbow joint are due to these bony overproductions, and at the onset we are confronted with two questions:

1. How and why do they develop?
2. Can we stop their development?

DEVELOPMENT

In answer to the first question we have many theoretical replies:

The simplest of these is that there exist within the anterior capsule of the joint certain cartilage cells. These cells are not fully developed and therefore when disturbed or traumatized they begin to proliferate. In this connection Key, writing of synovial membrane, has divided the structure into three types: areolar, fibrous and adipose. In discussing the fibrous type, he says, "I am inclined to regard these encapsulated cells as cartilage or transition stages between synovial membrane and cartilage cells."[1] We must admit that cartilage is, in reality, closely related to connective tissue and that it can be easily reproduced from a common connective-tissue matrix. Therefore, we cannot be satisfied with such a simple explanation.

As proof of the fact that these cartilaginous and bony masses are not from the periosteum or bone, but accrue within the capsule, permit me to refer to a case shown at the Academy of Medicine by the Department of Traumatic Surgery of the New York Post-Graduate Hospital in connection with a review of 150 fractures in or about the elbow. The mass shown was about 2 cm. in diameter and freely movable. Later it became attached to the ulna and humerus.[2]

The next theory is that these overgrowths of cartilage are entirely due to a circulatory phenomenon. Figure 1 clearly shows that the main arterial supply to this area turns sharply backward. An infusion within the articulation or a swelling of the soft parts about the joint certainly would impair the circulation through such a vessel.

Recently Professor Rene Leriche of France has written of his experimental work in this connection.[3] He has severed the sympathetic nerves governing the vessels and claims in this manner to have lessened the production of the synovial fluid. He described a condition of *traumatic arthritis*, claiming: "In ten days following an injury the cartilage, in part, is destroyed." He states: "Bony rarefaction accompanies hyperemia and results in a bad effect on the nutrition of the cartilage

which results in pain and functional disability." (This article, to me, is one of the best on the subject and should be care-

the cartilage for these bodies? Likewise in alkaptonuria, for example, areas of cartilage are affected.* We have no evidence


Figs. 1A and b. An elbow inflated with gas. Note the extension of the anterior capsule upward a distance of about 2 in. Also note the recurrent artery which supplies this area. (The wide lateral expansion is due to a faulty technique) . . Note the small amount of blood vessels in the region of the external surface and in the area about the head of the radius.

fully read by those deeply interested in joint pathology.) Granting that the circulation does play a very important part in cartilage production, the theory offered by Wollenberg, that cartilage cells require little nourishment and proliferate when the circulation to other tissue near them has been impaired, would seem to substantiate the circulatory theory that a diminution in the blood supply is responsible for such a condition.

Next we come to a still more theoretical consideration which seems to me to reach nearer to the depths of the discussion, that is, the chemical changes. We know that in certain diseases such as gout, purin bodies are found deposited in or near joints. Is there a chemical affinity of

that lack or excess of calcium or phosphorus is responsible for the condition, and must return to the theory advanced by me in the preceding papers: *The cartilage is rich in sulphuric acid.*[4] *Therefore is it not a fault in the sulphur metabolism, which is the true cause of cartilaginous over-production?* As an indication of this, do we not know that for years sulphur baths have been thought to be beneficial in joint conditions? It is known that cystein (amino-acid) assists in metaboliz-

* Formula for alkapton:
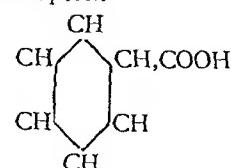
ing sulphur, and thus intestinal stasis can be connected with a fault in sulphur metabolism. Hahrminann, years ago, noted

FIGS. 2A and B. Case 1.

in his work on severe chronic arthritis, the fact that when what he calls high potany sulphur, was given his other medications seemed to be more effectual.

Miss A. B. Baylis,[5] in working with blood serum with lead acetate and lead sugar as reagents, noted in cases of severe arthritis that a heavy precipitate interfered with her reactions. This was thought to be caused by sulphur compound but proved to be a protein substance. (This work will be reported by me in a later paper.)

Finally must we add to the already complicated considerations a bacterial logical invasion. In dealing with acute traumatic lesions I have found no evidence to indicate that an acute or chronic infection is, in part, responsible for the condition. None of the cases has shown local reactions to indicate a pyogenic infection, nor have

there been any symptoms to indicate a general or distant focal infection. One of the cases (Fig. 2) was in a young man with incipient tuberculosis, but I do not consider that the tubercular lesion was a factor in the production of this huge proliferation.

CASE I (Figs. 2A and B). H. S., aged sixteen, came to Post-Graduate Hospital three weeks following a fall on the elbow, received while playing tennis. On September 22 a careful manipulation was done. He has failed to return for operation.

Numbers of cases have been seen in which the individuals were apparently in perfect physical condition. It might be said that the age seems to play only a small part inasmuch as the condition was encountered frequently in children, but also seen after forty-five.

CASE II (Figs. 3 A, B and c). B. D., a robust woman of forty-two, slipped and fell upon the street February 7, 1928. She was

taken at once to a nearby surgeon who claims to have reduced a dislocated elbow. Two days later, she came to the Post-Graduate Hospital.

FIG. 3A. Case II.

On February 9 she was operated upon for a fracture of the neck of the radius. A complete removal of the radial head was done. Note the extensive proliferation of cartilage and bone in B. We hope to gain the patient's consent for a second operation in the near future.

I am of the opinion that in those over fifty the condition seems less likely to appear, but to my mind this again reverts us to the chemical theory. Could it be that a lack of sulphur prevents these overgrowths in individuals who have entered the period of life's decline? If so, can we not reason that the giving of sulphur to such individuals would assist in the production of cartilage and thus be indicated on occasions where we have a delay in the union of fractures?

PREVENTION

Let us begin with the more practical mechanical and physical considerations.

Whenever I see a case in which there is limitation of motion due to excessive cartilage and bony production, and have

FIG. 3B. Case II.

in mind doing a manipulation under anesthesia to push away, as it were, the tissues blocking the joint movements, I stop and ask myself, "Am I right?" It is difficult to form an answer. At least, I have not thoughtlessly undertaken these procedures. By manipulation, shall I not stir up the cells to increased activity? On the other hand, will the patient be content to allow his joint to become less and less useful, and also permit his muscles to lose

their power? Would it not be well, therefore, to undertake a single careful manipulation?
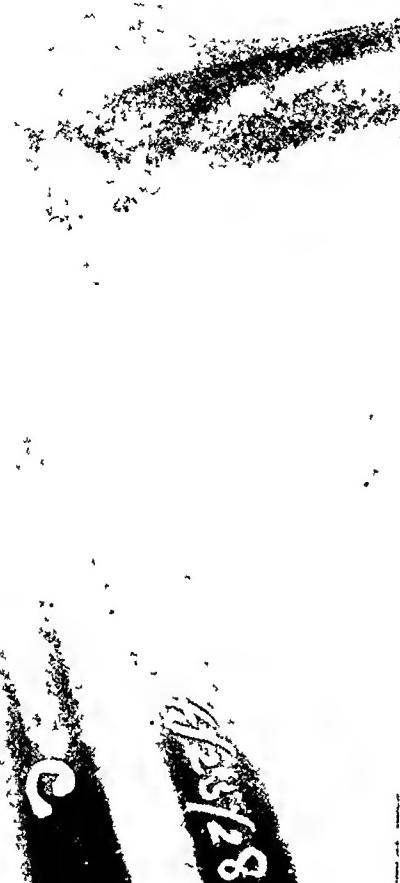
FIG. 3C. Case II.

Even before this, in an acute case, will one, by rough handling of the joint, cause a proliferation of cartilage which would not have otherwise appeared? Should wet dressings be used to assist in an early reduction of the swelling? I am in favor of immediate reductions of fractures; but where a joint is concerned, could we afford to revert to the older theory of waiting a short time? There is no argument that in all elbow fractures the acute flexed position advocated by Sir Robert Jones is an ideal procedure (the only exception being a fracture of the olecranon).

In knee conditions where there has been an effusion into the joint with or without hemorrhage, we advise aspiration; but in the elbow I have no knowledge that this treatment has been extensively carried out. Such an aspiration would relieve the pressure upon the anterior capsule and permit freer circulation of the blood in the recurrent artery supplying this area.

My experience has not been extensive enough to discuss any of the above mechanical considerations with a positive degree of certainty. If those treating such lesions would assist in the collection of data, we might arrive at a more definite conclusion in regard to the advisability of doing an immediate aspiration of the elbow joint.

Turning to physical considerations, what will heat do? It will increase the flow of blood. But it will, at the same time, increase the effusion within the joint, a thing not to be desired. Will not heat rouse the cartilage cells to more active proliferation? Therefore, is it not wrong to send such an elbow case for early baking or other methods directed along the same lines? In order that this discussion may not appear too theoretical, permit me to quote Dr. H. Halsted, who, in connection with industrial work, has reviewed the final end-results in more than 200 fracture cases in and about joints, and states that in his opinion, heat is strongly contraindicated, except in conditions of very long standing. With this I agree, and have come to believe that baking should be, at least for the first few weeks, omitted.

What will massage do? Again we must reply, "It will improve the circulation." But will it not cause an excessive growth, just as in the application of heat? Will it not disturb the existing cartilage cells to further proliferation? Can we then satisfy our patients by convincing them that it is a better policy to omit the usual treatments, such as massage, baking, etc? Figure 4 is an illustration of a case which was, let me say, "handled with gloves." By this is meant that early motion was begun by the patient, after five days of immobilization in the Jones acutely flexed

position. Active motion was encouraged up to the point of causing pain but too passive motions were carried out. This

No baking or external heat was used and no massage given in the immediate location of the joint. Note that with such treatment there

FIGS. 4A, B, C and D. Case III.

early motion is most beneficial in reducing the amount of joint effusion. As stated by Dr. Moorhead in discussing knee-joint injuries "There is no joint in the body in which active motion is more indicated, and none in which absorption of effusion is more quickly influenced by circulatory stimulation, than afforded by *self-massage*, induced by the patients' own action."[7]

CASE III (Figs. 4 A, B, C and D). L. B., a young lady, aged sixteen in most excellent physical condition, came to the Post-Graduate Hospital after having slipped and fallen down a flight of stairs, landing upon her elbow. For two days she entirely disregarded the injury. Upon admission, there was limitation in flexion beyond a right angle and on May 1, 1928 a *very careful* manipulation was done under gas oxygen anesthesia. The arm was put up in acute flexion with a Jones dressing applied. This case was most carefully observed. She refused operation for removal of the fragment, because of the scarring deformity following it.

was no appearance of cartilage or bony proliferation for a period of *nearly four months* (a much longer time than is usually required in cases treated by baking, frequent manipulation and vigorous massage at the fracture site). At the date of the first appearance of this proliferation she was treated with a large penetrating dose of roentgen rays. Less than three months later the process, instead of increasing had if anything diminished, in spite of the fact that there was a foreign body within the joint to keep up an irritation of the anterior capsular area.

As a similar example of a case where massage and baking were omitted, I recall seeing a child, four weeks after a most severe fracture into the elbow joint, playing about her home with a perfectly functioning elbow. Because of the discouraging roentgenograms, I was asked by the attending physician to see the case. There has never been any obstruction due to excessive cartilage production following this untreated fracture.

After an organized bony bridge has formed, what will be accomplished by an open surgical operation for its removal?

under local anesthesia the following day. The joint was, of course, filled with a mass of blood clot which was removed. The ulnar shaft and
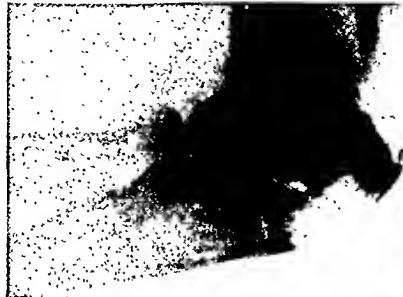
FIGS. 5A and B. Case IV.

What will be the best time to undertake such an operation? I am of the opinion that six months or a year should be allowed to elapse, for thus a second proliferation

fragment were drilled and tied with kangaroo tendon. Six months have passed and no proliferation which could be clinically detected, has so far been noted.

FIG. 6. Roentgenographic aspect of an acutely distended bursa injected with sodium bromide prior to removal.

FIG. 7. External appearance of bursa, with line of incision indicated.

would be less likely to develop, necessitating a second operation.

Finally, as an illustration of a severe damage to the elbow in the aged:

CASE IV (Figs. 5 A and B). M. Mc., an aged lady with a blood pressure of 220, was struck by an automobile on April 15, 1928. I operated

On discussing the means of preventing these conditions let us again revert to chemical theory. Should we restrict the sulphur intake? In lecturing upon arthritis I have tried to stimulate medical students

to test this theory as it applies, for example, to cases of hypertrophic osteoarthritis where excessive cartilagenous production plays a part in the joint condition.

Finally, can we prevent the proliferation of cartilage by means of roentgen-ray treatments? Professor Wm. H. Meyers of the New York Post-Graduate Hospital, although he does not offer great encouragement, has consented to cooperate with me in an attempt to destroy these cartilage productions. We have, however, treated only 2 cases and cannot, therefore, draw any conclusions as to the end-results obtainable from this procedure. In the cases treated it has been beneficial.

OLECRANON BURSITIS

In discussing cartilage injuries about the elbow it may be wise to discuss briefly our findings in 19 cases of olecranon bursitis reported by Dr. Mathewson and myself. We noted that untreated cases are likely to develop an osteomyelitis of the ulna at the attachment of the bursa to this bone and that it was a wise procedure to remove these bursae completely rather than attempt other methods of treatment. From Figure 6 you will note that this structure is nearly 2 in. in length and cannot be removed without an adequate incision such as is illustrated in Figure 7.

Following removal the area of attachment should be carbolized and the wound closed without drainage. The disability period in cases treated early is usually not more than two weeks, but in neglected cases where a low-grade osteomyelitis has developed, there is often a disability period extending over many months.[6]

CONCLUSIONS

1. Fractures into joints require special attention.

2. Sulphur metabolism may be an important factor in cartilaginous conditions.

3. Early aspiration is often indicated.

4. Early active motion is most desirable.

5. Wet dressings are frequently beneficial.

6. Baking may be contraindicated.

7. Operative interference should be delayed after proliferation has begun.

8. Roentgenograms may prove of therapeutic value.

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SEMILUNAR CARTILAGE CYSTS*

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CYSTS arising in the semilunar cartilages of the knee joint are rarely observed, only 26 cases having been reported since the lesion was first described by Ebner in 1904. The sequence in which the previous observations have been recorded is shown in the chart, Figure 1.

The purpose of this article is to present 10 cases; 1 of these, (Case 11), has been reported in a former publication. The clinical manifestations illustrate the cardinal symptoms of this unusual condition, and in 7 cases the diagnosis has been confirmed by excision of the cartilage and the pathological changes have been noted.

CASE REPORTS

CASE I. A male, aged thirty-five, a teamster by occupation, was examined on November 18, 1921. For about five years the left knee had been painful. The symptoms has never been severe until two years before, at which time he had an acute attack of "rheumatism" in the knee, which confined him to bed for six weeks. Since that time the pain had been more or less continuous and motion was limited.

There was a rounded mass 1 in. in diameter on the inner aspect of the internal tuberosity of the tibia. Motion of the knee was free, without crepitus, but he could not fully extend nor completely flex the joint. The roentgenogram showed a slight increase of the joint space on the medial side and a shadow resembling soft callus on the inner aspect. The Wassermann test was negative.

On November 22, 1921, the internal semilunar cartilage was excised. A cystic mass was found attached to and growing from the internal semilunar cartilage. The cartilage was detached posteriorly and protruded slightly outside the joint. The cyst was filled with clear gelatinous material, and the interior of the cartilage was partially calcified. The result was excellent.

CASE II. A boy, aged five, was seen on October 23, 1922, complaining of a limp and

HISTORICAL SUMMARY

			External Cartilage	Internal Cartilage	Male	Female
Ebner......	1904	First described cyst	1	..	1	
Schmidt.....	1906	Reported 1 case	1	..	1	
Eden.......	1911	Reported 1 case	1	..	1	
Riedel......	1914	Reported 6 cases	6	..	5	1
Ollerenshaw	1921	Reported 3 cases, referred to 2 cases seen by Furnivall	5	..	5	
Phemister...	1923	Reported 2 cases	2	..	1	1
Fisher.....	1924	Reported first case of internal cartilage. Referred to case seen by Furnivall	..	1	1	
Jean........	1924	Reported 3 cases	3	..	3	
Allison and O'Connor	1924	Reported 2 cases of external cartilage and also 1 case of internal cartilage	2	1	1	2
Campbell...	1924	Reported 1 case	1	..	1	
Kleinberg...	1927	Reported 1 case	1	..	1	
Zadek and Jaffe......	1927	Reported 1 case	..	1	1	

a swelling in the right knee which had been noticed three weeks previously. Examination revealed a rounded mass about 1 in. in diameter on the external surface of the right knee. Flexion of the joint was normal, but extension was limited at 160°. The roentgenogram was negative and the Wassermann test was negative.

An incision was made over the lateral aspect of the knee joint. A rounded mass was found arising from the external semilunar cartilage. The tumor including the cartilage was easily removed, and when excised, exhibited an

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encapsulated multilocular cyst with clear viscid fluid contents. The recovery was uneventful.

FIG. 1. Drawing showing operative exposure of cyst of external semilunar cartilage.

CASE III. A woman, aged forty-four, the wife of a physician, was examined on July 9, 1925. At intervals for one year she had been conscious of a dull aching pain in the right knee. Seven months before the examination an enlargement was noticed on the outer side of the knee. During the few weeks previous to examination the ache had been continuous with frequent shooting pains from the hip to the ankle and the growth had seemed to be more rapid. There was no history of injury.

Motion of the knee joint was normal, but was accompanied by a mild rubbery crepitus. The circumference of the knee joint was ¼ in. greater than that of the opposite knee, and there was an enlargement just above the head of the fibula which was firm and tender on pressure. The roentgenogram showed an area of increased density in the soft tissues at the outer margin of the right knee joint. The bones were normal. The Wassermann test was negative.

An incision was made on the lateral surface of the knee. The joint capsule was opened and the external semilunar cartilage was found enlarged with a cyst containing clear gelatinous

FIG. 2.   FIG. 3.

FIG. 2. Photograph of specimen from Case x, showing location of cyst in middle third of cartilage.
FIG. 3. Cross section of tumor and cartilage showing multiple spaces separated by thin-walled septa.

material. The joint was otherwise normal in appearance. The cartilage was excised and the patient made an uneventful recovery.

CASE IV. A nurse, aged twenty-two, was examined in January, 1925. Three years before, while on duty in the operating room, she had noticed pain and aching on the outer side of the left knee. The pain was originally felt during the menstrual period, and for several months recurred with the menstrual cycle, the attacks lasting four or six days. Shortly before the examination a nodule ½ in. in diameter appeared on the lateral aspect of the knee. This swelling was directly over the external semilunar cartilage and was tender on pressure. At that time a diagnosis of cyst of the cartilage was made and an exploratory operation advised. Within a week, however, the mass disappeared spontaneously, and the operation was, therefore, postponed. During the following year the pain gradually increased, each succeeding attack being of longer duration and of greater severity, and the intervals between the attacks of shorter duration until the pain was almost constant while the patient was on her feet. The sensation, according to the patient, was that of a foreign body in the outer portion of the joint.

Reexamination in January, 1926 showed no abnormality in the contour of the knee. There was no effusion. The range of motion was normal without crepitation but full extension caused pain on the outer side of the knee. The

cartilage was not visibly enlarged but on palpation a definite mass could be detected which seemed to be attached to the external semilunar

bone pathology, but an area of slightly increased density was seen within the joint space of the left knee in the region of the external

FIG. 4. Photomicrograph of a large section of the tumor. Low power. Shows border of a large cyst and two smaller adjacent cysts.

FIG. 5. Photomicrograph showing blood vessels in perichondrium with greatly thickened walls.

cartilage, and which was tender on pressure. The blood Wassermann was negative and roentgenograms of both knees were negative.

A provisional diagnosis of internal derangement of the knee, possibly a cyst of the cartilage, was made, and on March 2, 1926 the joint was explored through a lateral incision. The external semilunar cartilage was found to be enlarged and contained a small cyst at the peripheral border of its middle third. The anterior ⅗ of the cartilage was removed with complete relief of symptoms.

CASE V. A Russian fruit-dealer, aged forty, was examined on December 5, 1925. For several years he had been subject to recurrent attacks of pain and swelling of the left knee. There was no history of trauma, but these attacks were always more severe during cold weather. The preceding day had been the occasion of the most acute attack he had ever experienced and for twenty-four hours he had been scarcely able to walk because of pain.

Examination revealed a firm circumscribed swelling 1 in. in diameter just lateral to the patella tendon, apparently fixed to the tibia. The mass was tender to pressure and all movements were painful, especially full extension. Roentgenograms of both knees showed no

semilunar cartilage. The blood Wassermann test was negative. A diagnosis of cyst of the external cartilage was made, and excision advised. The patient would not submit to this and he has since been lost from observation.

CASE VI. A salesman, aged thirty-five, was examined on December 29, 1925. One week before he had struck the outer side of his right knee against an automobile door. The injury was not severe, there being no subsequent ecchymosis, but the immediate pain was intense and persisted for two days, causing a pronounced lump. He had also noticed stiffness of the knee on arising.

Examination showed a slightly rounded protuberance on the outer aspect of the right knee, anterior to the biceps tendon and on a level with the lower extremity of the patella. The tumor was about ¾ in. in diameter, tender on palpation, and apparently contained fluid under tension. The range of motion of the knee was normal. Roentgenograms of both knees were negative, and the Wassermann reaction was negative.

The cyst was aspirated and 1½ c.c. of clear gelatinous fluid withdrawn. The tumor immediately disappeared, the symptoms subsided, and to date there has been no recurrence. Culture of the aspirated fluid was negative.

CASE VII. A school boy, aged eighteen, was examined in July, 1927. Following a minor injury in a football game eight months previously, he had noticed a painful area on the outer side of the right knee. A slight swelling was present, and at times a light tap over the head of the fibula caused a tingling sensation in the lower leg.

Examination showed an enlargement, which was tender to pressure, just anterior to the head of the fibula. Motion of the joint was free throughout the normal range. Crepitation was present in both knees, more marked in the right. The Wassermann reaction was negative, and roentgenograms of the right knee were negative.

A diagnosis of cyst of the external semilunar cartilage was made, and on July 12, 1927 the joint was explored through a lateral incision. A cyst was found attached to the peripheral border of the middle third of the external semilunar cartilage. The entire cartilage including the cyst was excised. Grossly, the specimen consisted of the semilunar cartilage on the outer side of which was a large thin-walled cyst separated into several loculi and containing a greyish pink mucoid material. There has been no recurrence of the tumor, but the knee is swollen and painful in damp weather.

CASE VIII. A farmer, aged forty-two was examined on November 7, 1927. For five years there had been a small tumor mass on the outer surface of the right knee, just above the head of the fibula. This swelling had formed gradually, without antecedent injury, and had caused no inconvenience except an occasional slight pain. A few hours before admission to this clinic, while catching mules, he twisted his knee. There was immediate pain radiating from the mass through the knee joint, so severe that walking was impossible and opiates were required for relief.

The examination showed a firm rounded swelling of the size of a walnut, on the lateral surface of the right knee. The mass was directly overlying the external semilunar cartilage, was tense and cystic in consistency and tender on pressure. There was a slight increase of synovial fluid within the joint. Motion of the knee was normal. Extension of the knee caused the mass to become more prominent; flexion caused the mass to be less prominent. Roentgenograms of both knees were negative, and the Wassermann was negative.

On the following day the knee was explored through a lateral incision. A large multilocular cyst, containing a clear jelly-like substance

FIG. 6. Photomicrograph, high power, showing wall of one of the large cysts containing irregularly spaced cells with flattened nuclei.

was found arising from the mid-portion of the external semilunar cartilage. The cyst was in close relation to the synovial membrane and apparently had protruded through the membrane at a point close to the posterior attachment of the cartilage. The entire cartilage was removed with complete relief of symptoms.

CASE IX. A boy, aged eleven, was examined on April 7, 1928. For the previous two years he had suffered recurrent attacks of pain in the left knee. There was no history of injury, nor could the boy designate any factor which would precipitate an attack. When pain was present, however, walking aggravated it. The attacks lasted one or two days, were afebrile, and in the intervals the child seemed perfectly normal. The day before the examination, while running, the knee had locked and he had been temporarily unable to straighten it. Later the locking disappeared and at the time of the examination there was no disability.

Examination revealed a thickening which was tender on palpation 1 in. lateral to the lower border of the patella and along the joint margin. There was no limitation of motion of the knee. The blood Wassermann was negative. The roentgenogram showed a circumscribed

area of increased density in the soft tissues in the region of the external semilunar cartilage.

A diagnosis of probable cyst of the external semilunar cartilage was made, and an exploratory operation advised should the symptoms persist.

CASE X. A farmer, aged thirty, was examined in April, 1928. He complained of a tumor of the right knee which had slowly enlarged since it was first noticed five years before. He stated that there was a constant, dull aching pain in the knee which was aggravated by walking. There was no history of injury, and there had been no locking or snapping of the joint.

On examination, a mass, 1½ in. in diameter was found on the outer side of the knee at the joint line, just above and anterior to the head of the fibula. The tumor was fixed, tense, but semi-fluctuating and tender on pressure. Motion of the knee was normal, the mass moving with the tibia and being more prominent on full extension. The blood Wassermann test was negative. Roentgenograms of the right knee revealed a swelling with increased density in the soft tissues on the outer aspect of the knee joint. The adjacent portions of the articular surfaces of the lateral condyles of the tibia and femur were slightly flattened.

On April 24, 1928 the cartilage was removed. A curved incision was made on the lateral aspect of the knee. The cyst was carefully dissected away from the surrounding tissues and excised together with the external semilunar cartilage. The cyst arose from the middle third of the cartilage, was multilocular and contained clear, mucoid material. Following the operation the wound healed promptly and there has been complete relief of symptoms.

ETIOLOGY

In 31 of the 35 cases the cysts have involved the external semilunar cartilage, and in 4 the internal cartilage. The condition occurs most frequently in males, only 6 instances, including Cases III and IV of this series, being in females. The age of incidence varies from five to thirty-five years. Case II, in this series, a boy, five years of age, and Case IX, a boy eleven years of age, are the youngest patients in whom the diagnosis has been made. The etiology is not known. The theories which

have been suggested may be classified as: 1. Degenerative, 2. Traumatic, 3. Congenital.

1. *Degenerative Theory.* The earlier German observers were of the opinion that the cysts were due to softening and colloidal degeneration of the periarticular tendinous or periosteal tissues about the knee owing to deficient nutrition following trauma. Phemister agrees with this view and points out that the pathological findings are identical with those of the cystic swelling or ganglions which occur in various connective tissues, especially on the back of the wrist. Ledderhose attributed the pseudocystic degeneration to a primary obliterative endarteritis of traumatic origin. This endarteritis is not constantly present, and it more likely, according to Phemister, that the vascular alterations are simply a part of the degenerative process and not the initial change. Jean concludes that the lesion is a pseudocyst caused by a peculiar type of degeneration of the fibrocartilage from unknown cause, perhaps favored by the avascularity of the tissue. Allison and O'Connor believe that the cyst represents the end result of a degenerative process caused by interference with the blood supply of the cartilage in the affected region, the exciting cause of which is a non-lacerating injury. Kleinberg states that the cyst is due to some form of injury or to disturbance of metabolism of the cartilage cells without injury, following which defects appear in the meniscus. As pointed out by Jean, there is no support for the theory of bacterial infection. Culture of the contents of the cysts and of fragments of the cartilage have been negative and there are no symptoms of inflammation. The blood Wassermann test has been negative in all cases.

2. *Traumatic Theory.* Practically all observers agree that trauma plays an important part in the causation although only about one-half of the reported cases give a history of definite injury. Fisher suggests that the trauma may be either from without or may be indirect through

strain of the tendon of the popliteus muscle, as this muscle lies in close approximation to the middle portion of the external semilunar cartilage at the one place at which the outer margin of the cartilage is covered by synovial membrane. Fisher also states that the cyst is a ganglion developed between the synovial membrane and the outer surface of the cartilage, although he admits the cyst may invade the cartilage. Zadek believes that the cysts are due to ingrowth of the synovia following tears of the outer portion of the cartilage. The chief argument against the traumatic origin is the fact that the cysts usually occur in the external cartilage while the internal cartilage is much more frequently traumatized. Also, it must be remembered that the tendency exists to attribute all joint disabilities to remote injuries.

3. *Congenital Theory.* Ollerenshaw has suggested that the cysts are developmental in origin due to fetal rests of the endothelial cells in the cartilage which, when stimulated by trauma, are rapidly distended. This embryonic hypothesis, which is analogous to the inclusion theory proposed by Cohnheim as the specific cause of neoplasms, is not generally acceptable.

PATHOLOGY

The gross appearance of the cysts in the 7 cartilages which we have excised has been identical and corresponds with the description of all previous cases. In 6 the external cartilage was affected and in 1 the internal. The cysts were located in the peripheral portion of the middle third of the meniscus, definitely within and a part of the cartilage, their outer walls being formed by a thin shell of expanded fibrocartilage. On the interior the cysts were divided by fibrous septa into several communicating cavities of varying size, the larger loculi generally lying toward the periphery of the tumor and the smaller ones centrally. The large spaces appeared to be formed by coalescences of the smaller cavities. The inner surfaces of the walls were smooth and glistening and the mucoid substance, thick

and transparent, sometimes slightly tinged with red or yellow, resembled the colloid material in ganglions.

The microscopical appearance of the cysts has been a subject of debate. Ollerenshaw was the first to describe a definite endothelial membrane lining the cysts; other authorities state that no lining membrane is present. Kleinberg found the larger cysts lined by a layer of large flat cells resembling endothelial cells which he believed had probably arisen from lymph vessels. Zadek described the smaller cysts as lined by a membrane consisting of synovia-like endothelium. On the other hand, Phemister could find no evidence of an endothelial lining, nor could Prof. Latulle or Dr. Guy who examined the specimens reported by Jean, nor Walbach, who examined the cases reported by Allison and O'Connor.

Our impression from the examination of 7 cases is that the cysts arise from the splitting of the connective tissue fibers along parallel planes, and that no definite lining membrane is present. A careful microscopical study of Case x was made by Dr. J. A. McIntosh, whose report is as follows:

A section cut transversely through the specimen of cartilage consists largely of fibrocartilage with greatly thickened perichondrium. In the fibrocartilage there are many small linear spaces which seem to have been formed by cleavage along parallel surfaces. None of the cysts are spheric. The perichondrium is thickened and contains numerous thick-walled blood vessels and dilated lymph spaces. In the zone near the perichondrium there are irregular clumps of pale mononuclear and polynuclear cells.

A section through the wall of one of the large cysts shows many smaller smooth lined spaces traceable from the very small ones to the largest. In a few places the impression is gained from the regularity. of position of the low elongated nuclei that there is a lining membrane, but there are other sites where the nuclei are not so regularly spaced and still many other sites where nuclei are absent. In the largest cyst there is a delicate areolar con-

nective tissue attached to a portion of the wall and it appears as if several smaller spaces had ruptured into the larger space leaving remnants of the ruptured wall floating in the fluid. The thickened blood vessels and infiltrating wandering cells indicate chronic inflammation. The relation of the cyst-like spaces and the dilated lymph channels is uncertain.

SYMPTOMS

The duration of the symptoms varies from a few weeks to several years. Case VI was observed one week following trauma, the symptoms having appeared immediately. Phemister states that the cysts seem to attain their maximum size within a few weeks, after which they remain stationary, and that there is no instance of spontaneous disappearance. This is probably inaccurate. In our fourth case the tumor subsided after a short duration although the other symptoms persisted, and in Case V the symptoms were recurrent. In Case VI the tumor disappeared and the pain was entirely relieved by aspiration of the colloid contents of the cyst.

The symptoms are similar to those of other derangements of the knee joint but without locking or snapping. Pain, limp and interference with joint motion, associated with a visible and palpable tumor in the region of the cartilage, are characteristic manifestations. The pain may or may not be constant, and is aggravated by functional use. The pain is also aggravated by rotation of the leg and is worse on full extension and flexion of the knee, the most comfortable position being at about 70° or 80° of flexion. The tumor is firm, resistant to pressure and tender. The size of the tumor varies but the location is fixed and unchangeable. It is always immediately overlying the cartilage on a level with the joint line and is firmly fixed to the tibia and moves with the tibia in all movements of the knee joint.

The roentgenogram is usually negative although a shadow in the soft tissues in the affected region may be visible, and rarely, as in Case X, there may be a slight flattening of the adjacent portions of the femoral and tibial condyles.

The treatment is surgical. Excision of the entire cartilage is recommended, as Riedel and Schmidt have reported the recurrence of the tumor when the cyst alone was removed. The functional result depends upon the damage to the joint structures by the mechanical pressure of the tumor.

CONCLUSIONS

1. Ten cases of cyst of the external semilunar cartilage are reported; in 7 the diagnosis has been confirmed by excision of the cartilage.

2. The etiology is still obscure, but the majority of observers agree that the cyst is caused by a degenerative process in the cartilage.

3. No definite lining membrane was demonstrated.

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PRIMARY LUNG CARCINOMA[*]

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PHILADELPHIA

IN the past six years we have had occasion to see and study 11 cases of primary lung cancer. From the bronchoscopic clinic at the University Hospital we have had opportunity to see and study the roentgenograms of a number of other cases. From this association it has seemed to us that either the disease is becoming much more frequent or else it is being more easily diagnosed.

Boyle[1] is credited with having "vaguely described pulmonary cancer" in 1810 and Stokes is credited with having distinguished several varieties of the disease, in 1842, his work being published in the *Dublin Journal of Medical Sciences*. Although Ebermann,[2] in 1857, was able to collect 72 cases of supposed lung cancer, it remained for Jaccoud[3] ten years later clearly to distinguish this disease from tuberculosis. Microscopical studies of primary lung cancer were first made by Langhans,[4] Marchiafava[5] and Malassez[6] during the years 1871 to 1876. Since that time the literature has grown to very considerable proportions so that Adler,[7] in 1911, was able to tabulate 374 cases and a few years later, in 1916, Scott and Forman[8] reported 120 additional cases. The increased frequency can be readily understood when one finds that Brunn[9] in a very admirable paper on this subject, which was read before the American Association for Thoracic Surgery, in May 1925, was able to collect 626 cases from the literature.

INCIDENCE AND ETIOLOGY

In collecting 382,671 necropsies, from 1872 to 1898, Brunn found 159 cases of primary lung cancer, an incidence of 0.04 per cent. From 1898 to 1916, in 192,271 necropsies he found evidence of 488 cases or 0.24 per cent, an incidence six times greater than that reported in the first group. From 1916 to 1924, in 33,308 necropsies there were 71 cases, an incidence of 0.21 per cent. Ewing[10] believes that primary cancers of the lung are found in 1 per cent of all cancers, while Kauffman[11] places the incidence at 1.83 per cent.

In the reported cases the disease occurs nearly three times as frequently in the male as in the female, while in our own cases, 6 have been males and 5 females. Although, as in many diseases, cases have been observed at the extremes of age, 90 per cent of the reported cases have occurred between the ages of forty and eighty and 62.5 per cent between the ages of forty and sixty years.

From the reported cases, many of the records of which are incomplete, the right lung seems to be affected more often than the left. Perrutz[12] in 106 cases found the lesion in the right side in 54 per cent, on the left in 35 per cent and bilateral in 10 per cent.

The etiology of this disease is obscure as is the etiology of all cancer, but it presents many interesting problems which will warrant considerable study. Long-continued irritation, chronic inflammation and infection have been considered by many as the major etiological factors. In this connection the work of Alfred Arnstein,[13] of Vienna, is interesting. In a dissertation before the German Pathological Society in 1913 he discussed the occurrence of pulmonary cancer among the miners of the Schneeberg district of Saxony. The minerals mined are mostly cobalt, bismuth and nickel. Cancer of the lungs was given as the cause of death in 44 per cent of the deaths of the miners admitted to the hospital in this district. Since few necropsies were performed, it is

likely that many of these deaths were due to tuberculosis or pneumoconiosis, but in the necropsied cases the incidence of cancer was high.

Although Rokitansky,[14] in 1854, stated that tuberculosis and carcinoma were antagonistic, especially in the same organ, we now know not only that this observation was false, but that tuberculosis is considered a major etiological factor. In fact, Ewing very positively says it is "the chief etiological factor . . . In the old scleroses, atelectasis and reparative lesions of tuberculosis may be found many alterations of bronchial and pulmonary epithelium, marked by considerable cellular overgrowth."

In our own experience the disease has been much more prevalent since the influenza epidemic of 1919. The chronic bronchitis, which persisted in so many cases and which is so often associated with an overgrowth and metaplasia of the bronchial mucous membrane, may offer a nidus for the origin of the lesion in that in this, cellular alteration may lead to a lack of tissue restraint. The greater frequency of cigarette smoking with the tendency to inhale the smoke, and the increased bronchitis coincident with increased dust and smoke, may also be factors. One of our cases was a miner and we await with considerable interest further studies such as those made by the Bureau of Mines in regard to pneumoconiosis to determine the relationship between anthracosis and malignant disease.

TYPES

There are three groups of lung cancers. The disease may arise from the (1) bronchial epithelium, (2) bronchial mucous glands, or (3) alveolar epithelium. Any specific gross anatomical and clinical features that these groups may have belong nearly entirely to the very early stages of the disease and as such are rarely recognized.

The squamous-celled carcinoma, which is the type most frequently seen, originates from the epithelium lining the bronchi. It is usually of slow growth and when favorably situated it may, especially if seen early, be suitable for surgical treatment. These tumors frequently cause occlusion of a bronchus during their growth. The superficial tumor may become necrotic and bronchiectatic cavities result. The ulcerating and dilated bronchi may form cavities in the center of the tumors and as such may be mistaken for bronchiectasis or lung abscess. The tumors arising from the bronchial lining epithelium may also be of the cylindrical-celled alveolar carcinomatous type. The group as a whole is characterized by papillary projections from atypical proliferation of the lining epithelium. In these hemoptysis is fairly common.

The carcinomas arising from the bronchial mucous glandular epithelium are in the majority of instances limited chiefly to the walls and especially the submucosa of the bronchi. The lining of the bronchi is rarely invaded and bronchial stenosis rather than bronchial dilatation occurs. The structure is that of an adenocarcinoma or alveolar carcinoma having characteristics of the bronchial mucous glands. These tumors are characterized by excessive mucous secretion.

A diffuse or multiple and nodular tumor may arise from the lining of the pulmonary alveoli. A single lobe or the entire lung may be involved. Cavitation from necrosis is frequent. The pleura is generally involved and metastasis is frequent. In the nodular type the lung is peppered with many poorly defined tumors of varying size. The structure of this group varies considerably.

METASTASIS

The metastasis from these tumors is usually widespread, but as in all cancers it will vary with the degree of malignancy. The bronchial nodes are usually affected early. In 374 cases Adler reports invasion of the bronchial nodes in 117, mediastinal

45, tracheal 26, cervical 23, retroperitoneal 23, and with decreasing frequency in many other regions. The liver was invaded in 103 cases and the brain in 53; in fact few organs have been free from secondary invasion. The ribs, spine, skull and sternum are the bones most frequently involved in the order named. The heart is more often involved than in any other malignant growth.

SYMPTOMS

The symptoms of this disease are due to alterations of normal physiological processes. For this reason and because in the slowly growing tumors the remainder of the lung tissue attempts to compensate for tissue loss, the symptoms are variable and in many cases the patient is nearly symptomless until the tumor has reached inoperable proportions. The physical findings are often indefinite but with the symptoms they are at times extremely suggestive. Patients suffering from pulmonary malignancy are often admitted to sanatoria with the diagnosis of tuberculosis. The clinical laboratory is of little aid in the diagnosis, for negative sputum examinations exclude neither tuberculosis nor cancer. If the patient has indistinct signs of pulmonary tuberculosis and a definite pulmonary lesion, cancer should be suspected. It is the latency of pulmonary malignant growths that makes them so deadly.

In our own cases cough was the first symptom in the majority of cases. It was complained of as one of the major symptoms in 9 of our 11 cases. This is caused either by tracheal irritation of a hilus tumor, or bronchostenosis with the damming of secretions behind an obstruction, or bronchial dilatation with resulting bronchiectasis. In the cases of stenosis the cough is of a paroxysmal, barking type and there is little expectoration early. Later the increased secretion of the glandular endobronchial type of growth may give rise to profuse expectoration. In the cases which have associated bronchiectasis the expectoration is usually profuse and at times purulent, especially when secondary infection has supervened.

The sputum is often blood-tinged or frankly bloody. This may appear early in the papillary growths arising from the bronchial epithelial lining or it may appear later when the growth has invaded the blood vessels surrounding the bronchi and alveoli. In those cases having associated abscesses with secondary infection the sputum is not unlike that of an abscess communicating with a bronchus. In none of our cases were we ever able to identify tumor cells in the sputum. Although this is given as a means of diagnosis, I believe that little reliance can be placed on a negative report. The characteristic currant-jelly or prune-juice type of sputum has also been lacking and, although it may occur occasionally, is not seen very often. It should also be remembered that tuberculosis was present in 10 per cent of all the cases reviewed by Brunn, so that a positive sputum does not exclude the possibility of a coexisting cancer. This should be kept in mind, especially with individuals past forty years of age.

In many cases dyspnea is an early symptom. In fact in many of the reported cases which were carefully analyzed it was the first symptom. As the dyspnea increases, cyanosis may become manifest. This is especially true if the tumor is close to the hilus so as to cause obstruction of one of the main bronchi or if, by pushing into the mediastinum, it produces tracheal stenosis. In the peripheral tumors dyspnea is a late symptom, but in the rapidly growing alveolar tumors it may appear relatively early. Since pleural effusion occurs in many of the peripheral tumors, especially those involving the pleura, this too may in some cases be the cause of the dyspnea.

Pain which is continual and agonizing is often an early symptom. In our own series it was one of the major symptoms in 7 cases. The interesting fact in relation to this symptom is that pain is often present when there is no evidence of pleural

involvement; that is, there appears to be a true visceral pain, although from what we know of visceral pain in general, this is difficult to believe. The pain may have a wide radiation and may not be confined to the limited area of pleural or pulmonary involvement. It is relieved only by morphine and then only for a short time. Paravertebral injection gives some relief, but because of the wide radiation of the pain this procedure is not as efficacious as might be expected.

Fever occurred in 9 of our cases. In some it was associated with chills and sweating. In every case in which fever was a constant symptom there were evidences of an associated secondary infection. Two of our cases were operated on for lung abscess, although in 1 of these the diagnosis of a preexisting malignant growth was made before operation. Abscess cavities, bronchiectasis and bronchial suppuration are frequent concomitant lesions of lung cancer and in such cases the marked febrile reaction is the result of the secondary infection. It should be stated, however, that even in the early cases we have noted a febrile reaction of 99°F. to 100°F. without any evidence of a superimposed infection.

Cachexia, in my opinion, is usually a late manifestation. It is not a prominent symptom until suppuration or extensive metastasis has occurred or until continual loss of sleep from recurring pain makes life unbearable. In the central growths cachexia may be a relatively early symptom, but these are the "silent tumors" and the loss of weight bespeaks an advanced age of the growth or a very rapid progression of the disease.

Only 1 of our cases showed an advanced osteo-arthropathy. Although a second showed this to a slight degree, it was not as marked as that associated with long-standing pulmonary suppuration. It is my opinion that the majority of cases exhibiting this very interesting symptom have coexistent pulmonary infection and suppuration with the formation of abscess cavities or other ulcerations.

DIAGNOSIS

The latency of many of these growths makes diagnosis difficult in the early cases. We may say, however, that in doubtful cases it is well to consider malignancy, especially when pain, dyspnea and blood-tinged sputum are present. The first two symptoms are rarely seen in early pulmonary tuberculosis. The physical signs are often confusing. They may be entirely absent unless there is bronchial obstruction or the tumor is expanding toward the lung periphery. Even when present the signs may be masked by coexisting tuberculosis, bronchitis, emphysema, etc.

There are, however, several very important and direct aids to diagnosis. Of major importance is the roentgen ray. The roentgen-ray shadows of primary lung tumor present pictures that are quite unlike those of the more common inflammatory processes with which they are so often confused clinically. Stereoscopic and lateral views are of the greatest value and should always be made when primary carcinoma is suspected.

In 2 cases we have made the diagnosis from cervical glands which had become involved by metastasis. Unfortunately, such a procedure is applicable only to very advanced growths beyond hope of any help. In 2 other cases we inserted a large aspirating needle through an intercostal space directly into the tumor. In this way tissue may be removed for microscopic examination. In the cases with associated suppuration this must be done with considerable precaution. If other methods fail in establishing the diagnosis, exploratory thoracotomy and biopsy are permissible. The operation may be done under local anesthesia and entails no great risk. In the bronchial growths much help may be expected from the bronchoscopist. He can assist in clearing up suppurative foci that communicate with a bronchus and at the same time he can remove tissue for examination. In the endobronchial growths with bronchial stenosis early diagnosis by bronchoscopic means may be impossible.

TREATMENT

This may be divided into that tending to produce amelioration of symptoms and that attempting to cure. For the first irradiation is the only means at present at our disposal. In some cases the improvement, although only temporary, is marked. However, just as in the treatment of carcinoma of the esophagus, the roentgenologist cannot point to a single cured patient in a proven case.

The surgical treatment although hazardous is the only means of actually obtaining a "cure," if such is to be obtained. Unfortunately, most of the tumors are seen when metastasis makes operation worthless or when pleural adhesions increase the risk from lobectomy. Lobectomy is applicable in the treatment of central tumors. The mortality should not be as great as that after lobectomy for pulmonary suppuration. The peripheral tumors can be fulgurated or excised once the parietal and visceral pleura have become adherent. The danger here lies in opening the free pleural cavity. In the hilus tumors or those primary pulmonary growths which have involved the mediastinum surgical removal is as yet fraught with too great dangers.

There are, however, a number of these cases which if diagnosed early could be subjected to surgical treatment with a reasonable hope of cure.

SERIES OF 11 CASES

1. Males, 6.
2. Females, 5.

3. Age:
   Lowest, 35; oldest, 72; average, 54 years; 64 per cent between 40 and 60 years; 18 per cent, 70 or above; 18 per cent, below 40.

4. Duration:
   Shortest, 1 month; longest, 6½ years; average, 11 months, omitting case giving history for 6½ years. Average duration is 4.2 months.

5. Lung affected:
   Right side, 5; left side, 6. Lobe; right, upper, 3; lower, 1; whole lung, 1. Left, upper, 1; lower, 3; whole lung, 2.

6. Symptoms:
   Major symptoms complained of: 1, Pain, 7; 2, cough, 9; 3, hemoptysis, 5; 4, dyspnea, 6.

7. Evidences of secondary infections:
   Abscess, bronchiectasis or suppuration, 3; fever, 6; slight fever 3.

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RADIUM IN THE TREATMENT OF CANCER*

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REQUEST has been made that I discuss at this time the practical, present-day position of radium in the treatment of cancer. In order to do so I shall attempt to make an appraisal of and draw some conclusions from our experiences with this agent at the Memorial Hospital during the past twelve years.

I shall ask you to carry certain fundamental facts in mind throughout the discussion. The term "cancer" embraces a large group of closely allied diseases, of unknown cause, for which we have no specific treatment. Radium is a relatively new therapeutic agent about which practically nothing was known, clinically, fifteen years ago. The treatment of cancer today depends upon surgery, including cautery methods, radium, roentgen rays, and possibly some constitutional agents of the non-specific foreign protein therapy group. I say "possibly" because I am not advocating this form of therapy.

The present discussion is limited to but one angle of the general problem, namely, what has radium accomplished and what are its possibilities?

Apart from all therapeutic considerations I would place foremost the contribution made by radium to the general study of cancer. Until about fifteen years ago, cancer was looked upon, in general, as a single disease. Study of cancer treatment was almost entirely in the direction of problems incident to surgical anatomy and surgical technique. The latter has been perfected to the point where, broadly speaking, little more can be accomplished. The work of some of the best known radical operators of a quarter century ago compares very favorably with that of some of the more radical surgeons of the present.

Only recently has cancer been recognized as a large group of closely allied diseases with widely differing individual characteristics.

The physical agents, radium and roentgen rays have forced a very careful histological and biological study of malignant tissues. Such study is essential to efficient radiation. The prolonged, intimate and detailed observations, both gross and histological, incident to treatment by radiation, have given us a much clearer conception of the many groups of malignant disease coming under the general heading of cancer. Histological study of tissues under radiation is constantly adding to our knowledge of radiosensitivity or resistance. Indeed, several new groups of neoplasms have come to be recognized as definite clinical entities through their peculiar response to radiation. As outstanding examples, mention may be made of the transitional cell carcinomas described by Ewing and of the endothelial myeloma of bone, also first described by the same observer. Both of these tumors were recognized through their peculiarly ready response to radiation and upon further investigation proved to be very characteristic, both histologically and clinically. The clinical index, indicating the relative degree of malignant aggressiveness, as outlined by Broders, is applicable in large measure as a guide to the relative radiosensitivity of the tumor. From that large group of tumors formerly classed as fibrosarcomas we have found that the majority have their origin in nerve sheaths. These neurogenic tumors vary widely in their histological structure, and classification on the basis of Broder's cellular differentiation fits very well the variation in radiosensitivity. In other words, proper

* A lecture delivered at the New York Academy of Medicine, February 10, 1928.

relative histological classification within the group is a valuable guide to the response which may be expected from radiation. Conversely, the response to radiation in many types of tumor is of assistance from a diagnostic standpoint.

From a practical clinical standpoint, radium has relieved surgery of responsibility in the care of inoperable cancer. If radium has never cured or contributed to the cure of a case of cancer, it has amply justified itself as a palliative agent. There is no longer any excuse for attempting operative surgery in any but the most favorable case, on the ground that some effort must be made to relieve the patient. The growth restraint, with temporary complete or partial control of symptoms which may be accomplished through radium is far more effective than any of the former efforts at palliative surgery. As examples one might point to advanced carcinoma of the cervix uteri, or advanced carcinoma of the mouth, with or without cervical metastases. The rate and mode of growth may be altered, bleeding arrested or prevented, discharges eliminated and hence avoided. Pain may be considerably relieved or prevented.

This does not mean, however, that radium is an agent of last resort. I mention the palliative benefits here, not only because of their real merit, but to call attention to the fact that there is a decided difference between the employment of radium palliatively and curatively. In the latter instance, a much greater intensity of radiation is not only permissible but is essential.

The field of operable cancer has been limited in two ways by radiation. The limits of strict operability have been narrowed rather sharply in many groups, one of which is carcinoma of the breast. In many cases the grossly palpable evidence of disease may be anatomically and technically operable and yet the case be inoperable for certain reasons. The patient may be very elderly, unequal to the surgical shock or a very young one in whom the disease is practically never eradicated by

an extensive dissection. It may be a case in which the farthermost palpable nodes are questionable. There is no excuse for operating upon such cases with our present resources in the form of radiation.

Experience with radiation has gradually shown that certain groups of operable cancer are managed better by radiation than by surgical extirpation. As examples one might cite early intra-oral cancer and cancer of the cervix uteri. The latter group, probably more completely than any other group of malignant diseases, has gone completely into the field of radiation. Attention should also be drawn to the distinction between carcinoma of the cervix uteri and carcinoma of the fundus uteri. While involving different portions of the same organ they are histologically, anatomically and clinically different and on this basis the former group lends itself best to treatment by radiation, while the latter is best cared for by operative surgery.

Not only has radiation limited the field of surgical operability but it has altered considerably the character of cancer surgery. Many of the technical procedures have been altered and new ones introduced. Standard types of operative procedure have in some instances been curtailed because of employment of radiation to care for some phase of the disease in conjunction with surgical extirpation. It is frequently necessary to expose a tumor surgically in order to introduce and distribute radiation accurately. This procedure is resorted to in dealing with deep fixed masses in almost any part of the body, whether it be a fixed metastatic cervical node secondary to mouth cancer or an inoperable neurogenic sarcoma in the depths of the thigh. Buried radium emanation must be accurately placed to be effective: hence a median laryngotomy is indicated and amply justified in dealing with many intrinsic carcinomas of the larynx.

In this connection one might mention the limitation, by combining surgery and radium implantation, of many of the former extensive surgical procedures which might well be classed as horrible. I refer to

such procedures as total laryngectomy and many of the technical procedures carried out in an effort to get beyond intraoral growths.

This change in the character of cancer surgery brought about through combining radiation with surgery has, I believe, demonstrated that cancer surgery today represents a special surgical field, somewhat complicated because of physical considerations, and of a highly technical character.

The best treatment of cancer today requires both surgery and radiation; the two are interdependent. I specify "radiation" rather than radium alone, because both radium and roentgen rays are essential. There is little or no overlapping between these two physical agents. As far as large external doses are concerned, radium is superior to roentgen radiation if comparable quantities are used, but the economic factor is such that relatively few patients are fortunate enough to have the advantages of radium in adequate amounts for external distance doses. A good dose of roentgen radiation is obviously better than a poor dose of radium. Consequently, from an all-round practical standpoint the bulk of external distance radiation must be done with roentgen rays. On the other hand, radium lends itself best to localized surface applications, to introduction within body cavities, and to direct implantation in tissues.

As far as its application in cancer is concerned, radium is a surgical agent, and should be in the hands of the surgeon as a piece of additional surgical equipment. The surgeon who assumes to handle this new equipment must familiarize himself with its properties and action, physical, histological and biological, if he is to use it fairly and to best advantage. Radium must be applied accurately, whether on or in the tissues, and the method of application must be based on sound physical principles.

It is beyond the scope of this discussion to go into a detailed consideration of the mode of action of radium and the various tissue reactions. I must, however, call attention to the fact that the effect on tumor tissue, both inhibitory and destructive, is not brought about solely through the direct action on the tumor cells. The effect on the surrounding tissues—the tumor bed—is quite as important, in my judgment, as the direct effect on the tumor itself. The more embryonal the tumor, in its histological characteristics, the more radiosensitive it is; yet, there is a wide variation in its response, dependent upon the condition of the tumor bed. If the blood supply to this area has been altered by previous surgery, with its resultant fibrosis, the reaction will not be as favorable. In the presence of a marked secondary anemia or infection, the same lack of a normal radiation reaction is noted.

The technical and physical considerations incident to radium application are also too complicated to permit of discussion at this time, except to mention one point. This work is highly specialized and with added experience is steadily becoming more so. It cannot be carried out single-handed, to best advantage, in any sense of the term. An adequate radium supply is essential to provide the many variations in applicators containing radium energy for different types of cases. An adequate technical equipment is necessary to provide for this and a physical knowledge of the subject, of steadily increasing complicity, is essential to its application.

In some few instances radium alone is sufficient to control completely and eradicate malignant disease. This is true in the majority of skin cancers, in carcinoma of the cervix uteri, and in intra-oral cancer. For the most part, however, the combination of surgery, radium, and roentgen radiation is necessary to produce best results. It is unfortunate that in many quarters the idea seems to prevail that some sort of antagonism exists between surgery and the physical agents. Such is not the case. All are of value in combating cancer and in the most judicious combination of these agents lies our greatest strength.

The opportunities for combining these

forces are many. In conjunction with radial surgery in operable cases preoperative and postoperative radiation has proved of value: the former is, in my opinion, far the more reasonable and efficient. Under certain circumstances very thorough preliminary radiation prepares for a subsequent surgical procedure of lesser extent, yet affording a better permanent result. Some of the bulky growths of the lower rectum can be handled in this manner whereas the most radical surgical extirpation alone is useless.

As an immediate pre-operative or co-operative method of radiation, the direct implantation of filtered radium emanation at suspicious points in the surgical field affords the most accurate and efficient means of radiation at our disposal. We employ this combination always in our neck surgery for metastatic nodes secondary to intra-oral cancer. It is sometimes possible to treat a growth thoroughly by external and implanted radiation and yet leave a complication in the form of inadequate drainage. Here surgery may be resorted to simply to afford drainage with no responsibility for the direct removal of tumor tissue. This condition presents itself frequently in connection with growths in the maxillary antrum and accessory nasal sinuses. In this same location it is at times impossible to apply radium accurately throughout the tumor-bearing area because of upward and backward extension of growth. If such is the case surgery is resorted to, not only to facilitate drainage but to gain access for radium application as well. Surgical exposure with subsequent direct implantation of filtered radium emanation is a combination capable of wide application. We resort to it regularly in dealing with metastatic cervical nodes in which the disease has perforated the capsule of the node with secondary invasion of adjacent structures. The same may be done with fixed axillary nodes. Deep inoperable tumors anywhere may be more thoroughly and more accurately radiated by these means. The possibilities, particularly in connection with intra-abdominal tumors, are many. I have already mentioned this method in dealing with intrinsic carcinoma of the larynx, particularly those growths extending subglottic.

It is impossible to discuss here in detail the application of these combined methods in the many major groups of malignant diseases coming under the general head of cancer. Very few cases of cancer today are treated to best advantage without the participation of the physical agents at some stage. In many it is a problem of radiation alone. External radiation at a distance from the skin surface to permit of deep penetration and absorption is capable of the widest application. To date it has demonstrated its value and the future possibilities, in the light of increasing physical and histological data, are almost unlimited. This external radiation is provided by the use of heavily filtered roentgen rays or very large units of radium. For the more intimate applications of radiation, either surface, in body cavities, or by direct implantation within tissues, radium is the one source of therapeutic energy. The form in which it may be made applicable to the individual case is dictated by the type and extent, as well as the histological characteristics and anatomical relations of the growth, together with many physical factors.

The question is quite naturally asked: What are the results of combining radiation in so many forms either alone or with surgery in the treatment of cancer? On account of the wide variation in growth characteristics and the relative radiosensitivity of the many groups of malignant disease to be considered it would be obviously impossible to attempt an appraisal for each.

I believe, however, that our percentage of permanent results in unselected cases is approximately equal to those of surgery alone in the operable group. In addition, the amount of palliative relief is something which can neither be calculated on a percentage basis nor overestimated.

GENERAL PERITONITIS*

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MANCHESTER, N. H.

THERE are cases that come to the surgical clinic quite late or of relatively few hours' duration with a fulminating type of infection. Fortunately these cases are now much less frequent than a decade or two ago. However, patients in profound shock and extreme degree of systemic infection are still admitted. The rapid, thin, thready pulse and markedly distended abdomen, accompanied by persistent vomiting are conditions of very serious omen.

Many times in these cases the acute pain stage has passed and the temperature does not run extremely high, in fact may be subnormal. A signal for immediate surgical intervention, however, is the fact that the trouble began with severe abdominal pain accompanied by a temperature of 101°F. to 103°F. and later the pain subsided and the temperature dropped to base line or below. The dropping of the temperature seems to show rather poor resistance. The disappearance of acute, spasmodic pain, accompanied by abdominal distention, means that there has been a leak into the peritoneal cavity and a rapid formation of thin, floculent pus which has so toxicated the peritoneum that the nerve endings have become more or less paralyzed and the intestinal tract splinted by this dulling of peristaltic and segmentary movements.

The laboratory findings in these cases may be significant. The urine is likely to reveal a trace of albumen, and a rise of five or ten points in the specific gravity. The blood picture reveals a white count elevated in ratio to the individual resistance. The differential count shows the polynuclear leukocytes in the majority increased in direct ratio to the individual resistance of the patient. Upon admission the individual in extremis is dull mentally and very limited in physical activity, with an acute poisoning from an overdose of chemical toxines the result of infective fermentation. Such cases require immediate action and free drainage.

ETIOLOGY

This general infection of the peritoneal cavity may come from several sources: A ruptured gall bladder, a perforated gastric or duodenal ulcer, a ruptured appendix or pyosalpinx. These four sites of beginning are individually serious and demand early action. Of course innumerable other things might be considered, such as a perforation complicating typhoid fever, intussusception or volvulus with secondary gangrene and the soiling of the peritoneum, perforation empyema, trauma of external origin, ruptured pyonephrosis, etc. However these latter cases usually have a definite history leading up to the present condition and also are very likely to have a persistent vomiting. Our experience has been that pain and temperature do not have as much of a bearing upon the diagnosis as was formerly believed. In the majority of instances the appendix, pus tubes, gall bladder and gastric or duodenal ulcers, in the order given, are the offending members.

TREATMENT

This is most important, regardless of the case, as there is a general peritonitis and a very sick patient. The earlier drainage is instituted the better are the chances for recovery. In our own clinic it has been found that we give the patient the best chance by using free drainage with as little trauma and in as short a time as possible without attempting to explore the abdominal cavity too much. In the majority of instances the patient has been found far too ill for the primary cause to be removed.

Let out the toxic fluid, support the patient with adjuncts and give him a chance to immunize and rest, and he may get by the hazardous turn. It is very important to establish sufficient drainage from the bottom of every quadrant of the abdomen, and especially the lower half.

In these cases the patient generally leaves the table in a somewhat shocked condition. The dexterity with which the operation is done, combined with expediency and accuracy, together with the method of administration of the proper anesthetic, all very materially assist in reducing the degree of shock. In our clinic it has been found that a normal saline solution given by axillary sup during the operation will aid very much in these cases.

Axillary Sup. Saline is given by this method during the operation. A two-quart reservoir is suspended on a staff at the head of the operating table. By the use of a lengthy Y rubber tube with a No. 9 gauge needle at the end of each arm, the saline is permitted to flow continuously into the axillary spaces thus permitting the patient to drink from one pint to two quarts during the operating period. The method of introducing the sup needles is important. These needles should be directed perpendicularly to the body surface piercing the skin covering the outer third of the pectoral muscles and continuing on piercing the pectoralis major muscle and in this way entering the axillary space and being entirely free in this area. By so directing the needle the pectoralis major muscle holds the needle perpendicular permitting of a free flow of the saline and as the axillary spaces are freely distendable they will each easily hold one quart of the fluid. Thus the patient is permitted to drink freely of saline kept at an even temperature by coils of the rubber tubing resting in a basin of sterile water kept at an even temperature.

Our experience has shown that many patients coming to the operating room in a poor condition and with extreme toxemia, emerge in a better condition than when they entered, through the use of the axillary sup. The pulse will be improved, the color better, the general circulation augmented and the respirations deeper, more even and regular.

Axillary sup is a general supporter. By its influence the toxemia of general anesthesia is diluted postoperative vomiting almost entirely eliminated. This is a great help to these cases in extremis. They have enough bodily exertion before them without the additional strain of vomiting and its resultant weakness.

Early Skin Activity. Here again a beneficial effect of the axillary sup is observed. Early and vigorous skin function has a tendency to make the patient feel better. By this free perspiration the cellular waste toxines are eliminated in large quantities and the individual cells allowed to function properly without any harnessing or clogging. When the patient is returned to bed the axillary spaces are well filled with a supporting fluid. They not only drink freely during the operation but they continue to imbibe freely during the two or three hours after returning to bed. This drinking is accomplished directly into the lymphatic and general circulation without any local irritation to the gastric mucosa. The patient remains water-logged without being compelled to upset the stomach.

Again, the post-anesthetic thirst of which patients so often complain is entirely eliminated by the use of the axillary sup. That parched sensation in the mouth and esophagus does not appear. The dryness of the respiratory tract is not noticed. The elimination of these disagreeable sensations following the administration of any general anesthetic is certainly a boon to the patient.

Another favorable effect of the axillary sup on these extremely toxic surgical cases is early kidney activity. The kidneys begin hyperactivity on the operating table, and within a very few hours after being put back to bed they secrete large amounts of urine and void freely. Thus the toxic protein waste material and excess of uric

acid are secreted and excreted. This is of great assistance to the already overtaxed bodily economy of the patient. By the time the axillary spaces are empty the patient is ready to drink water freely and the supersaturation can most profitably continue.

Glucose Axillary Sup. Another advantage of the use of the axillary sup in these cases is that it promotes the freeing of glycogen at regular intervals, instituting self-feeding within the patient's own bodily economy. Up to this time the liver has been the storehouse of glycogen to be used when any physiological emergency arose such as extreme physical exertion. This being one of the chief functions of the liver, nature is ready to release it in health, and in disease the only thing necessary is a medium to take the place of extreme physical exertion. Glucose solution administered at regular intervals seems to accomplish this end.

Technique of Administration. In our clinic 40 c.c. of a 5 per cent solution of glucose is given every three hours. A 50 c.c. syringe with a 3 in. No. 9 gauge, Luer needle is used. The skin surface over the pectoralis major muscle is carefully cleansed and surgically prepared. Every precaution is taken as in a surgical operation and the field is carefully surrounded with sterile towels. The needle is then introduced perpendicular to the skin surface at a point approximately 1 in. inside of the outer margin of the pectoralis major muscle. The needle pierces the skin and is forced down through the pectoralis major muscle and into the axillary space. The fingers of the left hand guide the needle point as it reaches the axillary space. By using this technique there is no pain produced. When the syringe is emptied and the needle withdrawn the aperture is sealed with collodion. This amount of solution is entirely absorbed in about thirty minutes. The collapsed, toxic patient gets much benefit from this treatment.

Posture. With these cases in extremis the first four or five days count very much

when proper posture is instituted. What we term the modified Fowler position is used. The head of the bed is elevated by a wooden frame standard elevator which our carpenter made. The elevation from 6 inches to 2 or 3 feet as desired can be made. By using this standard the mattress plane is not broken and the patient lies flat so far as this surface is concerned. With the head of the bed thus elevated and the patient turned on the pendulous area side with pillows at the back and one pillow between the knees he is made very comfortable, the drainage is free and complete and he can sleep well. Thus added reserve is gathered and yet free and complete drainage goes on at all times.

Murphy Drip. For years our clinic has used this method of giving sterile water per rectum. The water is run through a heating coil kept at a temperature of 105°F. One drop per second is given permitting one dr. per minute to enter the lower bowel. If at any time this fluid is not retained, it is given for one hour only every third hour. In this way the patient can drink freely per rectum and thus supersaturate the body cells preventing too rapid cellular waste and resultant toxic protein accumulation.

Boric Acid Fomentations. In these severe general peritonitis cases we have learned that moist heat gives great service to the abdominal wall in resisting the extension of the infection. These moist applications also promote free drainage by augmenting capillary attraction. For these fomentations a saturated solution of boric acid in sterile water, temperature 160°F., is used.

Technique of Application. Strict aseptic precautions are followed out. The nurse scrubs just as thoroughly and carefully as for a laparotomy. An unsterile nurse acts as assistant to handle all unsterile materials and to prepare the bed clothing. The patient is prepared as for a surgical dressing. All dressings are removed and the wound surface cleared. The area is then carefully walled off with sterile towels.

Forceps are used to wring out the sterile flannel pads in hot boric acid solution. We have found that sterile flannel pads one foot square serve best to hold the heat. This is a very important part of the procedure. (As these flannel pads are received they are carefully washed in soap and water, then boiled for one hour and after being thoroughly dried in the sunshine and fresh air are again sterilized in the autoclave.) Three layers of these hot, moist, sterile flannel pads are applied over the wound and then a thick, dry, sterile, gauze abdominal pad is placed over these; this is covered with an oiled silk covering and the binder applied. The entire dressing is then superimposed with hot water bottles to keep the dressing thoroughly warmed, between changes. These dressings are continued from four to seven days depending upon the amount of drainage and tympany present. These hot boric fomentations are of great aid in maintaining capillary attraction, elevating the local resistance of the abdominal wall and maintaining local bodily heat. The wound is kept clean and no great accumulation of drainage is permitted so that the wound edges and skin surface are kept from re-infection.

Artificial Heat. To maintain a constant incubation of the patient he is wrapped in a heated blanket as the first layer of covering. That he be entirely enclosed in this blanket except for the head is a very important part of the technique. He is fully wrapped from the neck down, back as well as front, in the blanket and the bottom of it turned up under his feet. A sheet is then placed over this blanket and a dozen hot water bottles placed about the patient, five on each side from the shoulders to the feet and two bottles at the feet. Two blankets are then placed over the sheet and tucked in well on both sides. By carrying out this technique of wrapping the patient and changing the hot water bottles frequently, a constant, even heat can be maintained for the first twelve to twenty-four hours. By this procedure any bodily radiation is prevented and the thermic center is given a rest.

Medication. Drugs are seldom used in these cases. Of course if the cardiac muscle calls for extra temporary support, this is given in some form hypodermically. The same statement holds true relative to the control of pain. However, in recent years, no drugs are used in the average case unless urgently signaled for as in the case of the heart muscles or pain nerve transmission. The majority of cases do better without drugs. Now and then in the extreme cases a shock enema is given once or twice during the first twenty-four hours, but even this is used very seldom.

The above technique as carried out in our clinic over a period of years has given such satisfactory results and has so materially lowered the mortality rate in these in extremis cases that it has seemed worth while to review it.

THE RELATION OF THE
RETICULO-ENDOTHELIAL SYSTEM TO GENITOURINARY WORK*

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CHICAGO

EVER since Metchnikoff established the fundamental principle that all somatic functions depend on cellular activity and not, as was formerly believed, upon the influence of the somatic juices, special attention has been paid to this cellular function.

Later on Aschoff and Landau comprised the cells in which reside the defensive forces of the body under the name reticulo-endothelial system.

In order to justify the term system it was necessary to demonstrate that these cells show a uniformity as to origin, morphology and function.

As a matter of fact all these cells are of mesenchymatous origin; they are large monocytes and possess identical physiologic properties.

While they are originally found in certain predestined organs they may also be reproduced by metaplasia out of the cells of other structures, preferably the adventitia of blood vessels. The whole system is in a permanent stage of regeneration.

The physiologic properties of these cells are manifold and of great somatic dignity. They have a decided migratory tendency and transitory capability.

They are attracted to any area of increased metabolism, and are also able to penetrate the walls of blood vessels, thus entering the blood stream.

They are always ready for phagocytic action and are able to take up materials either in particulated aggregation or in solution.

Another of their characteristic qualities is their capacity of storing materials and eventually disintegrating them.

It was also noticed that the storage of one substance does not prevent their successively taking in materials of a different character. In fact the imbibition with certain proteins stimulates the functional capacity of these cells; the same holds good of moderate heating. Sudden flooding of these cells with toxines of streptococcic origin causes their death.

The cells of the reticulo-endothelial system are intimately connected with all phases of immunization and they are capable of producing defensive ferments.

For the diagnostic recognition of these cells the discovery of intravital staining was of highest importance. Stains that are of anodal convection, that travel toward the anode, are the stains of predilection of these cells.

Functioning cells store these stains in the conductive canaliculi only and not in their parenchyma. A thorough staining of the entire cell body reveals necrobiosis of the cell.

For the visualization of the imbibition of these intravital stains a direct biopsy is feasible only if tumors or other parts of the body are removed after the stain was injected into the circulation. In all other instances an indirect method has to be employed. A qualified amount of the stain is injected intravenously and the time of its disappearance out of the blood is noted. The rate of this subsidence permits of conclusions concerning the functional integrity or deficiency of the reticulo-endothelial system.

Appreciation of the functional dignity of this system clarifies many pathologic and therapeutic problems within the range of genitourinary work.

Testing the reticulo-endothelial system by the method mentioned above offers a chance of gauging the individual resistance of a patient.

The disintegrating capacity inherent in these cells is one factor that helps explain the failure to produce permanent results by transplantation of gonades.

The efficacy of medical diathermy in inflammatory infiltrations of prostate, epididymis and seminal vesicles finds a ready explanation in our knowledge of the activity of the reticulo-endothelial system.

The immigration, local neoformation and multiplication of the macrophages in the area of heating and subsequent hyperemia enhances the detoxifying of the structures involved and paves the way for the restitution to normality. The fact that moderate embodiment of foreign proteins stimulates the functional capacity of the reticulo-endothelial cells explains the efficacy of the aseptic protein shock in such instances.

The numerical increase and the energizing of the macrophages within the perithermic zone produced by electro-coagulation of tumors emphasizes the curative importance of this area. The stimulated macrophages in this region are not only able to attend to the particulated destruction of the remaining tumor cells but they are also known to produce defensive ferments.

During pregnancy the highest demands are put on the eliminatory and defensive forces. Not only is the metabolism of the entire system permanently increased, but into the circulation enter also the additional end-products of the placentar and embryonic metabolism.

It was found that in a great many pregnant women, especially in the later stages of gestation, the efficiency of the reticulo-endothelial system is considerably impaired. Then the eliminatory system works under a double disadvantage, increase of the metabolic slags and weakening of the defensive forces. Preexisting minor pathology may be aggravated and new renal disturbances may be created.

Edema and hyperplasia of the upper urinary tract as a regular concomitant of pregnancy furnishes an area of minor resistance. This, together with the impairment of the defensive forces, explains how pyelitis during pregnancy may assume an insidious and stubborn character or how originally minor obstructions of the upper urinary tract may develop in severe and permanent involvements as demonstrated by Danforth and Corbus.

The recognition of the pathology and pathologic physiology of nephritis together with our knowledge of the functions of the reticulo-endothelial system furnishes valuable pointers.

Nephritis is the local manifestation of a toxicosis of the general and renal capillary system. The subsequent deterioration of the capillaries not only interferes with the proper elimination of the end-products of the organic metabolism but produces also other irregularities. Unimpeded influx of toxines eventually leads to an excessive permeability of the capillary walls manifested by toxic transudation, to nephritic edema and to diapedesis of red blood cells.

Detoxifying the capillary system helps restore its eliminatory functions and the convalescence of the capillary walls prevents further transudation and hemorrhage.

This detoxification is the task of the reticulo-endothelial cells and it is rational to stimulate their efficacy before extended toxicosis produces irreparable destruction in the eliminatory system.

The most potent agents for raising the defensive power of the reticulo-endothelial system are medical diathermy and the administration of the aseptic protein shock. A timely application of these methods will necessarily improve the therapeutic results.

THROMBOSIS OF THE HEMORRHOIDAL VEINS*

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PHILADELPHIA

MULTIPLE thrombosis of the superior hemorrhoidal veins, usually referred to as acutely strangulated piles, is seen fairly frequently by every proctologist. It is the cause of much acute suffering and of a temporary invalidism. It is commonly thought that the internal hemorrhoids have protruded through the external sphincter and that this muscle has then gone into spasm, thereby cutting off the circulation of the hemorrhoidal tissues, and thus has given rise to a condition analogous to strangulated inguinal hernia.

This conception is manifestly incorrect. There is never the slightest difficulty in inserting one, two, or at times even three fingers through the external sphincter alongside the protruding hemorrhoidal mass, which procedure would be impossible were spasm present. In fact, the sphincter in this condition is in a state of partial paralysis.

In internal hemorrhoids without thrombosis the cardinal symptoms of prolapse and bleeding may be absent for variable lengths of time. Suppositories and pile ointments are used by individuals with reported cures. Of course, the pathology is still present; it is simply the symptoms that have been alleviated. It seems reasonable to suppose that the inconvenience to the patient is due not to the piles per se but to the associated low grade infection. Applications of various sorts and other non-operative procedures, such as divulsion, probably mitigate this infection and give a temporary improvement in the patient. When an increased infection is superimposed on these already diseased vessels, the weakened endothelial lining breaks and acute thrombosis results.

Pathologists differ greatly as to the causation of venous thrombosis. It has been held that the condition is due entirely to an alteration in the velocity of the current of blood, in addition to changes in the blood pressure, and that the bacteria which are present in the clots were brought there subsequent to the clotting. However, it is admitted that traumatism to a vessel wall will quickly produce thrombosis. Disease of the wall, due to bacterial infection, will produce a traumatism as does an externally applied force, and with the same result. It is the writer's belief that this is the etiology of acute thrombosis in the superior hemorrhoidal veins.

It is possible that strangulation may be a factor to a limited degree. Prolapse occurs constantly and is replaced regularly with attendant traumatism. At some time a prolapsed and diseased vessel ruptures, forms a clot and thereby increases the size of the mass protruding through the ring of sphincter muscle. As blood continues to pour into this enlarged mass the sphincter may constrict the latter and thrombosis occur throughout as a result. Then the muscle itself would lose its tone, due to continued pressure and long-standing disease and the usual picture would be quickly presented.

The writer has never seen this general thrombosis of the superior hemorrhoidal vessels without an accompanying general thrombosis of the inferior hemorrhoidal veins. The typical picture is of large mass outside of the anus sloughing and discharging freely and early accompanied by a great deal of pain.

When called to see one of these cases, the first thought of the surgically minded man is to operate at once, and this procedure is common, sometimes with dire results. The superior hemorrhoidal veins

empty into the inferior mesenteric and thus into the portal system. The lymphatics empty into the prevertebral lymphatics. Operative procedures in the acute stage stir up and spread the existing infection with a possible formation of a liver abscess. Even death has resulted from generalized infection.

The better plan of treatment is to put the patient at absolute rest in bed and upon a restricted diet. A wet compress of boric acid solution, either hot or at room temperature, is comforting to the patient and assists in promoting absorption of the clots. If the pain be great, morphine may be used either hypodermatically or by mouth. Opium suppositories are contraindicated here and at any other time. Opium has no local action and may be irritating in a suppository.

Sloughing may go on to a spontaneous cure of the hemorrhoids. If this should not occur, the hemorrhoids may be taken off by any appropriate operation, or they may be treated by the injection of 5 per cent quinine and urea hydrochloride solution after the clots have been absorbed and fibrosis has occurred, and when all acute symptoms have subsided, which period usually is not under three weeks from the onset of the acute disease.

If operation be resorted to in the acute stage a stormy convalescence may be looked for, provided the operator is fortunate enough not to have a more serious result. When the conservative method of treatment is generally followed, a few patients will get into the hands of the more radical operators and a few others will recover without the need of any operative procedure, but the final result in the case will be better. The conservative surgeon will have no fear of losing his patient to the mortician and he will not be likely to lose sleep because of any resultant emergency night call.

LABORATORY CRITERIA IN TREATMENT OF
LOCAL & GENERAL INFECTIONS
FROM A SURGICAL STANDPOINT*

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IN dealing with the subject of infection a simple terminological classification of the phenomena of infection on the following basis seems advisable:

1. The term infection should be used as a generic one and should include all of the phenomena of a bacterial attack on tissue, organ or the entire body and should be delimited by reference to the tissues, organ or part of the body involved, and in accordance with the organism or organisms encountered; thus, staphylococcus infection of the skin, or streptococcus infection of the liver, etc.

2. The term "bacteriemia" should also be used in a generic sense to indicate any condition in which bacteria can be cultivated from the peripheral blood during life, and should be described further in accordance with the organism found; thus staphylococcus bacteriemia, streptococcus bacteriemia, etc.

3. The term "general blood infection" may be employed to indicate a subgroup of the generic term bacteriemia in which the faculty of destroying the circulating bacteria is more or less lost by the appropriate antibodies of the blood, and in which, in addition, a multiplication of the bacteria takes place in the circulation.

Under appropriate circumstances both of these groups of terms should be employed together; thus staphylococcus infection of the skin with staphylococcus bacteriemia or general blood infection. The character of the local lesion in the complete development of any individual infection is best described by the use of the terms primary or secondary (metastatic, subsidiary); thus primary staphylococcus infection of the skin with staphylococcus bacteriemia, or primary steptococcus infection of the tonsil with secondary streptococcus infection of the appendix, etc., the absence of any descriptive bacteriemia indicating that a cultivation of the peripheral blood made during the course of the illness was sterile.

In clinical practice infection of the human body appears in one of the following forms:

1. A local lesion is present apparently without any constitutional symptoms. This must necessarily mean that the amount of constitutional disturbance is so small as not to be perceptible to the affected person or recognizable to a competent examining physician. The best examples of this type are the small furnucles that occur on the back of the neck.

2. A local lesion is present with general constitutional symptoms. The latter show an infinite number of variations both in degree and in kind, and the manifestations may be very severe and may terminate in the death of the individual. Positive blood cultures are not demonstrable.

3. Cases similar to those in Group 2 but in which living organisms can be demonstrated in the circulating blood. The bacteriemia may or may not be a temporary phenomena; the organisms may be present in the blood in cases that go on to recovery and may disappear from the circulation in cases that later end fatally.

4. Cases in which secondary lesions appear. Living organisms may not be demonstrable in the circulating blood, or may be demonstrable as a temporary or

permanent phenomenon; may be present in comparatively small or in overwhelming numbers; may be demonstrable in cases that go on to recovery, and may be absent during the entire course of the illness in cases that go on to a fatal termination.

5. Cases in which a bacteriemia or general blood infection exists but in which a local focus is not demonstrable.

There is a continuous contact between the various surfaces of the body and bacteria of all kinds. For this purpose the surface of the body should be considered to be not only the external skin but also the mucous membrane lining the entire extent of the alimentary canal, the entire lining membrane of the urogenital tract and of the pulmonary system. The epithelial lining of the ducts and the alveoli of all glandular structures in direct connection with any of these tracts is also an external surface of the body as far as the introduction of infection is concerned. The conjunctiva of the eyes is also an external surface. This is but an extension of the universal law throughout living matter that no relation can exist between living matter and its environment except through its surface.

It seems to be true that, even during states of health, traumas of one kind or another are constantly occurring to the major surfaces of the body (the skin or the intestinal mucosa) and that through these breaks bacteria of one kind or another are constantly entering the body. The protective forces of the body are, however, so strongly developed that interaction of bacteria or of their biologic products and surface cells is prevented or, what is more often the case, the effects of this interaction are immediately neutralized and the bacteria that enter are immediately destroyed. No perceptible effect is clinically demonstrable in the tissues either immediately or subsequently, and the condition of health continues undisturbed. This protection is a constant one during health.

I am strongly of the opinion that the assumption sometimes made, that bacteria can pass through an intact healthy body surface, is an incorrect one. I believe, as far as the external skin and the mucosa of the alimentary canal are concerned, that no entry of bacteria can take place without the intervention of some trauma, however minute it may be. Even in the presence of trauma, it is only in extraordinary instances that the natural protection breaks down and disease ensues, either because the opposing bacterium is one of extraordinary virulence, or because the character of the infection is one to which the natural antibodies have previously, either in the individual himself or in his race, been not at all, or insufficiently, developed. Anthrax infection and the incidence of unaccustomed diseases in savage, aboriginal or other similar races make excellent examples of this point.

Absorption of bacterial toxins from any primary lesion on a body surface occurs by way of the lymphatic system and by way of the blood stream. Penetration of the infecting bacteria into the body occurs also either through the lymphatic stream or through the blood stream. Both forms of communication are always necessarily present in all forms of infection. In certain classes of infection, especially those of the skin and of the distal parts of the extremities, the preponderance of the lymphatic form gives rise to the typical clinical picture known as lymphangitis. In the latter form of infection the progression of the process from its portal of entry is a continuous one along the lymphatic channels, and the spread of the infecting bacteria into the body is a continuous penetration and growth along the lymphatic channels. Infections entering through accumulations of lymphadenoid tissue, notably the tonsils and Peyer's patches, are typical forms of lymphangitis as thus defined, and the progression of the infection along the lymphatic channels can be frequently demonstrated clinically in the secondary involvement by continuity of the regional lymph nodes in connection with these

surface areas. In all forms of lymphangitis it is not possible to cultivate living organisms from the peripheral blood stream during the duration of the infection.

A differentiation commonly made between local and gereral forms of infection does not, theoretically, exist. Every local infection must necessarily have some general effect and every general infection must at some time have been associated with a local focus from which it was derived. The distinction is one more of convenience than of accuracy.

Penetration of the infecting organisms from the portal of entry into the rest of the body occurs by way of the blood stream and is intimately associated with the subject of venous thrombosis. The protective (inflammatory) process associated with any infection has as one of its prominent characteristics the slowing of the blood stream and the formation of venous thrombosis. The growth and multiplication of the bacteria in the focus of infection occurs in the thrombotic areas where in a relative way they are mechanically blocked from further progression, at least temporarily, by the occluding thrombus. However, the bacteria find an excellent culture medium here, and unless their powers of further growth and development are destroyed by the natural forces of the body, they continue to multiply and to penetrate the clot until they reach the surface of the thrombus, where the bacteria come into contact with the freely circulating blood in a connecting of the vascular channel. A number of possibilities develop as a result of this biologic progression:

1. The thrombi form a sufficient barricade and successfully localize the bacteria away from the circulating blood. Under such conditions no bacteria can be demonstrated in cultivations of the peripheral blood.

2. The growth of bacteria on the surface of the thrombus in contact with the circulating blood results in numbers of the bacteria being thrown off into the blood stream. In some cases the bacteria destroy-ing powers of the blood are sufficient to kill the organisms as fast as they are thrown off, and in these cases positive blood cultures are not obtained. In other cases the bacteria-destroying powers of the blood are only sufficient to kill the organisms a little less quickly than they are shed into the circulating blood. Positive blood cultures are then obtained but the number of organisms demonstrable in the peripheral blood remains small and the bacteria do not appreciably increase in numbers in successive blood cultivations. In practice recovery is possible and frequently occurs from such forms of bacteriemia. The best examples of this are the milder bacteriemias associated with osteomyelitis and the cases of sinus thrombosis after middle-ear infection with mastoid involvement.

3. The growth of the bacteria on the surface of the clot in contact with the freely circulating blood is unhindered by any bacteria-destroying powers and the organisms accumulate rapidly in the blood. In this form also the bacteria multiply in the blood stream itself. These cases are hyperacute forms of general blood infection and are almost invariably fatal. The commonest example of this is the fulminating form of general blood infection associated with severe forms of osteomyelitis and infections by the bacillus of anthrax.

Under any of these three conditions the thrombi in the focus of infection contain living bacteria. Under any of these three conditions pieces of the original thrombus or clumps of bacteria break off and are swept away in the circulation to all and any distant or near part of the body. Such vascular or bacterial emboli form the cause of any and all secondary lesions. Clinically the discharge of such "showers" of bacteria into the free circulation are frequently accompanied by chills.

The location of the secondary foci are determined by the arresting of the emboli at some point or points of the vascular network; and the actual point depends sometimes on an external trauma but more

often it is described by the physics of the local capillary circulation, or by the anatomic peculiarities of the local vascular network, or by mere chance. Various pathologic pictures result, depending on the organ or tissue in which the embolus lodges, the size of the plugged vessel, the relative position of the plug, the facility and faculty for vascular anastomosis and collateral circulation in conjunction with the character and virulence of the organisms, and the general powers of resistance of the subject as a whole. Most typical pictures are obtained in osteomyelitis and in the metastatic furuncle of the lung. The dominant characteristics of the pathologic pictures of the secondary foci are (1) a thromboarteritis or thrombophlebitis, and (2) more or less necrosis consequent to disturbance of the local circulation. In certain tissues such as bone, the necrosis plays a dominating rôle in determining the pathologic picture: in certain others, as in the lung, this is a negligible factor.

These secondary foci can and do occur in any tissue or organ of the body. Bones and joints, the lungs and the kidneys are possibly the commonest locations in which secondary foci develop. The most important location, from the gravity of the complication which it produces, is the endocardium and heart valves.

Character of Organisms Found on Culture. Facts obtained by studying cultures of purulent or other material (exudate) obtained from a demonstrable local focus of infection frequently serve valuable purposes. The information can be classified as follows:

A. The mere presence of organisms in the exudate serves as a means of diagnosis. The best example of this is the finding of pyogenic or other organisms in spinal fluid.

B. The character of the infecting organism frequently serves as a means of differential diagnosis and at the same time helps materially in establishing the prognosis, that is, the demonstration of anthrax bacilli in an otherwise indifferent-looking lesion changes the outlook to an extremely grave one. In other instances the character of the organism becomes important when the lesion is in a given tissue, that is, the presence of Welch bacilli in a focus of infection in muscle tissue makes an otherwise favorable prognosis potentially fatal. Cases are constantly being seen in which it is difficult to decide whether a focus of infection has localized in a bone or in an adjacent joint. True enough, this sometimes indicates a simultaneous involvement of both, but in other cases the localization is hidden in a general inflammatory reaction. Under these circumstances, the demonstration of organisms of the staphylococcus group, Staphylococcus aureus especially, indicates that the chances are greatly in favor of an involvement of the bone; the demonstration of organisms of the streptococcus group would speak in favor of an involvement of the joint. The differentiation carries with it a possible therapeutic indication. Other things being equal, the demonstration of organisms of the staphylococcus group with its consequent interpretation of a lesion of the bone would ordinarily favor exploration of the bone in cases of doubt; while the demonstration of organisms of the streptococcus group would indicate a more conservative treatment, at least as far as exploration of the bone was concerned.

C. Recently abdominal puncture has been practiced in cases of general peritonitis, either as a method of diagnosis in doubtful cases or as a means of differentiating a pneumococcus or streptococcus peritonitis. When these organisms are demonstrable, it indicates that the peritonitis is a metastatic one and is unassociated with a definite focus of infection in an intra-abdominal viscus which is amenable to surgical treatment; the prognosis then becomes extremely grave; the usual custom is to refuse to operate in these cases.

D. In infections of the middle ear the demonstration of a mucoid encapsulated coccus is commonly accompanied by a rapid destruction of tissue, which is unac-

companied by perceptible clinical or other evidence. Exploration of the mastoid is then indicated, although with other types of bacteria operation would not be considered.

CLINICAL CLASSIFICATIONS. Blood cultivations of the peripheral blood can be employed in cases of acute infection for the following purposes: (a) in appropriate cases as an additional means of differential diagnosis; (b) as a means by which the severity of the infection can be gaged; (c) as a help in estimating the prognosis; and (d) as criteria on which to base the primary or further operative treatment.

A relative quantitative estimation of the magnitude of the infection can be established according to the number of colonies of bacteria which appear on the plate (plate culture method) in proportion to the amount of blood used to inoculate the culture medium in the plate; thus, 1 or 5 colonies of bacteria per cubic centimeter of blood as compared with 100 or with an uncountable number of colonies of bacteria per cubic centimeter of blood. This is a rough method and is not strictly accurate, but for practical purposes the inaccuracy is inconsequential.

In practice the presence or absence of bacteriemia or general blood infection and its relative magnitude yield the following clinical groupings, and the correct interpretation of the bacteriemia in its relation to the clinical manifestations yields certain therapeutic indications:

A. Cases in which the blood cultures are sterile. Good prognoses should be the rule under these circumstances, and the method of treatment should be planned with regard to the local focus of infection only. A reservation should be made in one's mind, however, to cover those cases of acute infection in which, for some reason the thrombophlebitis begins to spread; in these cases positive blood cultures may be obtained later, and the character of the illness may change entirely for the worse.

B. Cases in which the blood cultures yield approximately from 1 to 5 colonies of organisms to the cubic centimeter of blood are usually, but not always, of a mild nature, are associated with symptom complexes which do not differ materially from those in similar cases in which the blood cultivations are sterile, and frequently disappear spontaneously or after operation. Good prognoses are the rule in these minor bacteriemias, and the method of treatment usually can be planned without regard to the bacteriemia.

C. On the other hand blood cultures can be obtained in which the numbers of colonies are extremely large, 100 or more colonies to the cubic centimeter of blood. This always indicates a severe infection and an extremely grave prognosis. The clinical picture commonly shows an equal evidence of the severity of the infection.

Any kind of local condition may be associated with such a general infection.

This group contains those fulminating forms of bacteriemia and general blood infection in which a demonstrable local focus of infection is of minor consideration and in which the general blood infection is the dominating factor in the entire clinical picture. Under these circumstances, treatment directed to the local lesion is clinically futile, and fatalities are the rule and not the exception. The uselessness of even the most radical surgical procedure is usually easily recognizable by the overwhelming rapidity with which the clinical picture passes into one of terminal delirium, coma and death.

There are other somewhat less severe forms of acute infection in which the blood also contains large numbers of viable organisms, but in which the clinical picture does not carry with it that comparatively sudden overwhelming of the body with a profound toxemia. A somewhat more hopeful attitude can be entertained in these cases, and whenever the local conditions make it possible, the question of radical surgery should be discussed in the hope of controlling the bacteriemia by removing the local focus from which it derived.

D. Between these two extremes are large

numbers of cases in which the cultivation of the blood shows an intermediate number of colonies of bacteria. Correct judgments are more difficult in these cases. Usually an aggressive policy is indicated, and whenever possible operation should be performed with the object of removing the thrombophlebitic lesion from which the bacteriemia is derived. Thereafter watchfulness and repeated blood culture studies are necessary. A careful study of the latter permits certain deductions of therapeutic value.

In cases of this kind, when a given blood culture is compared with subsequent ones taken on the same patient, decrease in the number of colonies or their disappearance undoubtedly indicates improvement when other conditions are equal; an increase in the number of colonies should always cause alarm, a prompt reconsideration of the available clinical picture and revision of all of the demonstrable foci according to rules that I shall give. Comparisons made along these lines are of extreme usefulness and importance at the bedside and in the operating room.

In the presence of a positive blood culture a prognosis of the ultimate outcome should not be attempted except after consideration of all the available clinical facts. While a positive blood culture is always serious, the seriousness of the possibilities is usually paralleled by the characteristics of the clinical picture. The prognosis should always be guarded. Much depends on the availability of the local focus of infection for thorough surgical removal, and on its removal before other complicating foci have appeared, and on the presence or absence of an endocarditis. Much depends also on the patient's resistance. Instances repeatedly occur in which individual antibacterial powers are sufficient to overcome the demonstrable bacteriemia, so that at no time, in the absence of evidence of a fulminant and overwhelming infection as previously mentioned, or in the absence of an endocarditis, should a hopeless attitude be entertained.

Negative Blood Cultures. Negative (sterile) blood cultures obtained either primarily or secondarily should always be associated in one's mind with the milder type of infection or with improvement. The contrary may be true and negative blood cultures may occur in the presence of the most profound infections. The most important groups in which negative blood cultures are obtained as a rule include infections of the lymphangitis type and infections in which the path of absorption lies through the portal area. It must also be remembered that negative blood cultures may indicate only a temporary bacteriemia, that is, interval between others in which bacteriemia is present. In clinical practice temporary bacteriemias can be unintentionally produced by operation and other manipulations, as for example, in the dressing of a wound, notably a wound of the bone, the passage of a sound into the bladder and other procedures. The lesson to be learned is that manipulations of the kind should be practiced with great care and circumspection, and should be avoided altogether if possible. Unnecessary and unwise squeezing and other treatment of lesions, notably of furuncles and carbuncles, especially of the face and upper lip, may convert a seemingly innocuous lesion into a fatal one complicated by a thrombophlebitis of the facial vein and of the cavernous sinus.

Gravity of the Local Lesions Apart from Bacteriemia. In the presence of positive and negative blood cultures a progressive impoverishment of the general condition of the patient and an ultimate fatality are frequently due to the magnitude and number of the various points of fixation that have occurred or to their location in important viscera or localities of the body rather than to the presence of the blood infection.

Relation of Local Lesion to Bacteriemia. In any given case a demonstrable bacteriemia may be referable to the original primary lesion at the portal of entry of the infection or to any secondary or subsidiary focus of infection. Because of the throm-

bophlebitis which is produced at the point of fixation, secondary foci can also give rise to a bacteriemia; these include especially foci of osteomyelitis and a bacterial endocarditis.

Primary bacteriemias are more commonly demonstrable and recognizable as such in cases of infection by specific organisms, as, for example, the gonococcus bacteriemia accompanying an acute gonococcus urethritis or the pneumococcus bacteriemia accompanying a pneumococcus pneumonia of the lobar type. Somewhat less commonly the primary bacteriemia is recognizable as being due to the original primary lesion because the latter is available for discovery and observation on an exposed surface of the body, as for example, the bacteriemia which accompanies a carbuncle or furuncle of the skin or that which accompanies streptococcus tonsillitis. Sometimes both of these factors, the specificity of the organism and the location of the lesion on a surface of the body, favor the recognition of the primary bacteriemia as such; as, for example, the bacteriemia which accompanies an anthrax lesion of the face or the bacteriemia which accompanies typhoid fever, in which the portal of entry is on the mucous surface of the ileum and the primary lesion is in Peyer's patches. Except under these specific conditions the available instances in which the demonstrable bacteriemia can be recognized as primary and as being derived from the primary lesion at the portal of entry seem to be in the minority.

In other cases distinct primary and subsidiary lesions coexist and are associated with a demonstrable bacteriemia. Then it is commonly difficult to say whether the demonstrable bacteriemia is derived from the primary or from the secondary lesion. The best examples of this difficulty are found in conditions of the ear in which a primary lesion is found in a complicating thrombosis of the lateral sinus, and secondary lesions are found in a bone or in a joint. Here the primary lesion remains a constant factor even in the presence of subsidiary foci which can themselves originate bacteriemias. Even after the jugular vein has been efficiently tied, a bacteriemia may still be derived from extension of the primary thrombus along the petrosal sinuses, and it is a nice distinction to integrate a bacteriemia properly between a subsidiary focus elsewhere in the body and the primary lesion in the lateral and petrosal sinuses.

Lastly, in still other cases a focus of infection is present which is distinctly a metastatic lesion, and which is accompanied by a bacteriemia. In the one group of such cases a primary lesion is sometimes demonstrable as a definitely healed lesion. A common example of this clinical fact is found in cases of acute hematogenous renal infections (hematogenous multiple renal infarcts); frequently, indeed, the site of the original furuncle is still recognizable in a recently healed scar. In the second and much more common group of these cases the primary lesion is undemonstrable. The commonest example of this status is found in cases of acute osteomyelitis. In the presence of any of these combinations experience leads one to assume that for clinical purposes all of these bacteriemias should be associated with the demonstrable metastatic lesion. Fairly complicated situations can and do arise, and the explanation of the bacteriemia becomes a matter of exclusion when several foci of infection coexist.

LABORATORY CRITERIA FOR THE TREATMENT FOR THE LOCAL LESION

Treatment for the local lesion should be based upon a consideration of all the facts outlined in this discussion. Multiple foci should be treated individually along similar lines and in accordance with the points of view expressed.

A. Other things being equal, the absence of a demonstrable bacteriemia or general blood infection indicates that a conservative attitude can be assumed in deciding the correct method of surgical treatment of the local focus. The immediate important

results of this conservative attitude include: (1) the performance of a much less severe (frequently a minor) primary operation; (2) much less chance of the spreading of the thrombophlebitic or thromboarteritic process with all the consequences outlined; (3) frequent conservation of important organs or tissues; (4) frequent avoidance of unnecessary complications.

B. Other things being equal, the presence of a demonstrable bacteriemia or general blood infection indicates a dangerous and possibly progressive lesion; it also indicates that an urgent effort, commensurate with the severity of the infection, should be made to remove the local focus as early and as completely as possible before the spreading infection does irreparable damage to the endocardium or to some important organ or locality. All the information classified in the previous part of this and in other papers as regards the clinical and therapeutic significance of a bacteriemia or general blood infection should be considered at this time and judgments formed and indications met accordingly. The important indication is to remove the local focus of infection as completely as possible. Conservative treatment should be replaced by radical removal of tissue into healthy areas in an attempt to reach a point distal to the thrombophlebitic lesion. There are times and localities in which radical removal of the thrombophlebitic focus is not technically feasible; under these circumstances, as much as possible should be done in this direction and the rest must be entrusted to nature's efforts to dissipate the bacteriemia spontaneously.

POSTOPERATIVE INFECTION

The phenomena associated with and accompanying a bacteriemia sometimes occur after operation (so-called "operating room infection") in divers parts of the body. Such infection does not always predicate an introduction of organisms from without. The bacteria may come from unrecognized foci of infection pre-existing in the body, as, for instance, in the tonsils; the wound then becomes a secondary focus.

As a general rule postoperative infections with demonstrable bacteriemia are extremely serious and usually terminate fatally. Clinically the patient has high fever and chills; the chills usually occur at irregular intervals whenever swarms of bacteria are being sent into the circulation. The local area of the operative wound need not necessarily show more evidences of change than are seen under more happy circumstances, and it is always impossible to discover any other focus of infection which could account for the bacteriemia.

In certain areas of the body and after certain operations, for instance in the pelvis and after amputations of the breast for carcinoma, the proximity of large veins to the operative field should make one suspect that the circumstances outlined in the foregoing paragraph are associated with an infected thrombosis of the adjacent vascular channels. Exploration of these venous channels is urgently indicated; when the thrombi are found, these should be removed and the veins tied on their distal side. The latter operation will succeed in direct proportion to the shortness of time during which the thrombi has been allowed to feed bacteria into the blood stream; success will not always follow when secondary foci have been established, and never when the endocardium becomes secondarily involved.

A CLOSED ASEPTIC AND QUICK METHOD OF GASTROINTESTINAL ANASTOMOSIS*

A PRELIMINARY REPORT

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THE trend of surgical procedure within the abdomen is slowly being changed from the open to the closed and


FIG. 1.   FIG. 2.

FIG. 1. Two angulated 8 in. forceps held together by a metal u clamp with nut. Jaws are 23 cm. long and 5 mm. wide.

FIG. 2. A. Set screw attached to the forcep. Arrows point to cerrations upon the box lock on the inner surface of the forceps. These help to hold the forceps together when locked. B. Arrow points to groove upon box lock to fit nut of the set screw.

aseptic method of anastomosis. The open method of gastrointestinal anastomosis is attended with a certain amount of post-operative complication and with fatalities that are directly due to spilling of contents or contamination from the opened bowel. Perfect asepsis in an operation is of utmost importance for the welfare of the patient, and it is the ideal for which the surgical profession has been striving. It cannot be obtained with ordinary precautions that prevent infection due to extraneous causes. An operation should be carried on aseptically to its completion, and this cannot be done with an opened stomach or intestine.

With the forcep which I have devised it will be possible to perform any type of anastomosis with perfect asepsis. It embodies the principle of a closed method of anastomosis, thereby eliminating the possibility of spilling of the contents and also preventing contamination. C. A. Perret[1] of Berne, Switzerland and F. W. Rankin[2] of the Mayo Clinic have each devised an instrument for a closed method of anastomosis. The former uses a single instrument made up of forceps of various sizes, which he calls invaginators. Rankin's is a three-bladed clamp with the center blade fixed. They both have reported favorable results with the use of their instruments and claim that the closed method is advantageous over the open method.

The author's forcep can be used in any type of anastomosis with this exception: it cannot be used after a wide resection of the stomach. It is of special value in resecting an ulcer of the stomach or duodenum. This cannot be done with the Rankin clamp nor with Perret's invaginators. Experiments are now being conducted by

[1] Perret, C. A. Surg. Gynec. & Obst., 44: 378, 1927.
[2] Rankin, F. W. Ibid., 47: 78, 1928.

L. D. Moorehead, W. J. Pickett and the author upon the following operations: Resection of gastric and duodenal ulcers, gastroenterostomy, lateral anastomosis, end-to-end anastomosis and end-to-side anastomosis. The greater part of our experiments are resection of ulcers and gastroenterostomy, because these have not been experimented upon utilizing the principle of closed method of anastomosis. If the experiments substantiate the principle involved in the forcep this will be indicated whenever an anastomosis is required. It will eliminate postoperative peritonitis and reduce operating time to one-half of that consumed by the standard methods.

The instrument is composed of two separate 8 in. forceps which when brought together are held by a set screw. The jaws are 23 cm. long and are grooved in the inner surface to prevent slipping of the tissues. The handles are angulated to permit freedom of movement and handling. The results of the experiments and the technical procedure for the various operations will be described in a future article.

SAW HORSES INSTEAD OF CRUTCHES*

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THE illustration is self-explanatory. This is a simple, practical method of assisting old people to regain the use of their limbs after long confinement in bed with a fracture. Any carpenter can make a saw horse. The hand rail is about 30 inches long and of convenient height from the floor. The feet are about 12 inches apart and are placed at an angle. If made of oak they are light and strong. The patient is taught to take steps of equal length and he does not get into the habit of limping. He walks between parallel bars which inspire confidence because they are firm and do not upset. Mrs. B. fractured her femur May 24 and the picture was taken September 10, 1928, on her eightieth birthday.

* Submitted for publication November 1, 1928.

Fig. 1.

DEMONSTRATION OF TABLE FOR CYSTOSCOPIC AND ROENTGEN-RAY PROCEDURES*

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THIS table under consideration was devised to fill the urologist's daily needs without unduly straining his
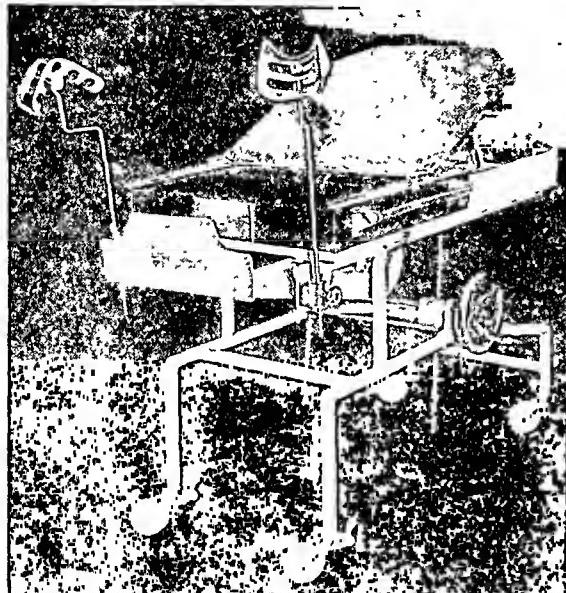
FIG. 1. Cystoscopic roentgen-ray table.

purse and without duplicating accessories which he probably possesses.

It consists of a flat Bucky diaphragm set in a frame with an adjustable monel metal back rest attached. The whole is mounted on a long well balanced base in such a manner that the patient can be tilted 45 degrees in either direction by turning one wheel. This is adequate to establish mobility of the kidney by pyeloureterograms made under cystoscopic visual control, the method of choice. The patient is placed on the diaphragm, the cystoscopic manipulations completed and the roentgen ray work done without having to move the patient at any time.

Bierhoff type of leg holders, very simple, adjustable, are provided. An unusually large deep drain pan is attached in such a manner and of such construction as to protect the operator, the floor, and the table.

No tube stand is attached. I believe that a fixed attached stand is not compatible with the highest degree of protection against accidents. Moreover it does not permit of a varied stereoscopic technique, nor of the use of small films for detailed study of selected areas.

No irrigating stand or illuminating rheostat is attached; each of you has his own preference in these details, and the equipment for it.

An easily attachable leg piece is provided whereby the table is immediately converted into an ordinary examining or roentgen ray table for general use.

The whole unit is mounted on large lockable wheels and so balanced that it is mobile or fixed as one pleases.

* Read before the Section of Genito-Urinary Surgery, N. Y. Academy of Medicine, Oct. 17, 1928.

RESORBABLE TAMPON

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DURING the course of studies on cholecystectomy, the writer had occasion to make use of a catgut tampon which seems to offer definite advantages.

Every catgut ligature used for hemostatic purposes in the liver cuts the liver tissue. In order to avoid this, I have made use of a small tampon of specially prepared and shredded animal membrane, which is readily resorbable. The material itself is cotton-like in consistency and can be sterilized at 120°C. without being injured. I have made particular use of it in difficultly controllable hemorrhages on the surfaces of parenchymatous organs (liver, kidney, brain), and the fact that it is readily resorbable makes it very useful because the wound can be sewed up without drainage, resorption being completed in from eight to fourteen days. Even in cases which must be left open, I have found it very useful to put the resorbable tampon at the bottom of the wound so that when the gauze tampon is taken out the patient has practically no discomfort.

In infected wounds the tampon has been useful because when saturated with antiseptic material it is rapidly absorbed and the antiseptic released. This is naturally of advantage in various surgical procedures.

The process of resorption of the tampon has the following characteristics, as seen from microscopic sections made. A small-cell infiltration of the filamentous meshes of the tampon sets in from the edges of the living tissues after about twenty-four hours. This infiltration progresses slowly, until it has reached the very center of the tampon. As early as this there can be noticed a gradual disintegration of individual filaments near the edge of the living tissue. This process, after an initial acceleration, diminishes more and more in older sections, and finally they disappear from the picture altogether. Giant cells are often noted in young sections, but later they are no longer present. The formation of connective tissue is quite minimal and almost entirely confined to the surface of the wound. In case of moderately thick tampons, resorption can be looked upon as complete after a fortnight or three weeks.

It may be mentioned as a matter of history that attempts to gain a resorbable tampon date back to the 80's. When modern surgery was still in its infancy, Gluck tried to get hemostasis through massed catgut, but the material used by him was not really suitable for resorption. Jaeger and Wollgemuth made similar attempts before the war, as the author noticed on perusal of the literature; but even they did not get beyond the first stages of experimentation. Recently Vogel has obtained a fluid hemostatic tampon, suitable and indicated for purposes other than those in question.

LARGE LIPOMA OF THE BACK*

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A LIPOMA may arise from connective tissue as well as from adipose tissue.[1] The "embryonic rest" occurrence. There is general agreement that there is no malignant form, but that they are true tumors, as their fat is not reduced

FIG. 1.   FIG. 2.   FIG. 3.

theory gives a reasonable explanation of so many lipomas starting in tissue which normally contains no fat.

A lipoma is surrounded by a fibrous capsule, but is loosely attached to it. A very delicate capsule forms the surface of the tumor and is continuous with the areolar tissue forming the trabeculae of the tumor. Histologically the tissue of a lipoma resembles normal fat. Calcification, necrosis, gangrene and sloughing are common complications. These tumors do not produce metastases, but may be of multiple

in the case of extreme general emaciation. They may grow to enormous size. Usually the growth is slow and gradual, though it may vary. If they occur in regions where traction is exerted by their weight lipomas tend to become pedunculated. If treatment is necessary because of deformity, ulceration or pain, surgical removal is indicated. The capsule is opened freely and the tumor enucleated from it. The separation is to be started inside the capsule.

CASE REPORT

A. S., male, aged seventy-five, No. 1764. Operated on March 14, 1925. From earliest

[1] Ziegler, E. General Pathology. N. Y., Wm. Wood & Co., 1908.

*Submitted for publication, December 6, 1928.

childhood two small tumors were present on the inner aspect of the left scapula. One began to grow slowly and by his nineteenth year had attained about one half its present size. From this age until he was seventy-three the growth remained stationary. During the two years before operation it doubled in size. For six months before operation there had been an area of ulceration near the tip of the tumor, the odor of which made him a most objectionable companion. With the ulceration he had run a slight intermittent temperature, lost some weight, tired easily, and shown an accentuation of the mental peculiarities which caused him to be called "simple-minded" all his life. Except for a mild arteriosclerosis, his general condition was good for a man of seventy-three.

Under ether the tumor was dissected free and its fascial attachment excised. For a week there was slight serum drainage from the lower angle. He was discharged cured in ten days, and a year and a half later was well, and there had been no recurrence of the tumor. The pathological report was lipoma. The mass weighed just under 20 lbs.

CHRONIC INTUSSUSCEPTION*

Fred W. Solley, m.d.

NEW YORK

BOY, ten months old, was admitted to the Babies Hospital January 5, 1928. C. C. Abdominal cramps and vomiting, one month's duration.

The pain was manifested by screaming and doubling up, and these attacks were very frequent during the first week, occurring several times a day, but during the last three weeks before admission they had gradually decreased in frequency. The vomiting was described by his mother as a spilling over of sour food recently eaten. This too was frequent at first, and decreased during the last three weeks before admission. The vomitus was never seen to contain any blood or mucus.

Stools were slimy from the onset, but his bowels *moved every day* up to admission, and were never constipated or very loose in character. Two weeks after the onset he had several very black tarry stools. One week before admission one or two drops of red blood were seen, but at no other time.

Previous history irrelevant. Birth normal. Birth weight 6 lbs. 9 oz. Nursed until eight months old. Always well in every way.

Physical examination on admission: Temp. 99°F. Pulse 100.

Fairly well developed but markedly emaciated white boy of about ten months, resting quietly and showing no evidence of pain or discomfort. The child looked somewhat dehydrated.

Except for large tonsils, the abdominal and rectal examinations showed the only positive physical findings.

The abdomen was rather scaphoid and soft and not in the least distended. A soft doughy elongated mass was very easily palpable in the left side of the abdomen especially in its lower two-thirds. The mass was movable, not tender, and seemed to be about 1½ in. in diameter or more, and at least 5 or 6 in. long. The upper and lower ends of the mass were lost on palpation rather than any definite termination being definable.

Rectal examination revealed a soft mass about the size and shape of a cervix but much softer. The mass was just palpable with the tip of the examining finger. On moving the abdominal mass the rectal mass moved also.

Laboratory findings: w.b.c. 12,200, p.m.n. 74 per cent, l. 26 per cent.

Urine: Acetone + + +, otherwise negative.

Because of the child's dehydration, and the fact there was no evidence of an acute obstruction, it was considered advisable to give a hypodermoclysis of 300 c.c. of 5 per cent glucose solution and postpone operation until the next day.

At operation under open ether anesthesia a middle right rectus incision 4 in. long was made, and an ileocoecal type of intussusception found, with the intussusceptum extending practically to the rectosigmoid junction. Work-

*Read before Section of Surgery, New York Academy of Medicine, April 6, 1928.

ing within the abdomen, the distal end of the intussusceptum was gradually and very easily worked up through the colon by a milking type of manipulation; this was very easily continued until only the last 3 or 4 in. of the intussuception remained to be reduced. At this point difficulty was encountered, so the remaining tumor mass was delivered through the wound. By a combination of milking applied to the intussusceptum and very gentle traction applied to the invaginating terminal ileum the reduction was completed without undue difficulty. At this point the child's pulse had become very rapid so without attempting to suture the terminal ileum to the cecum to prevent a possible recurrence, the wound was closed.

In spite of the month's duration of the condition the involved intestines showed very little reaction. There was considerable edema of the cecum and terminal ileum, but only very slight redness.

The postoperative course was remarkably smooth after the first day. On the first day the temperature was between 104°F. and 105°F. P.R. On the second day it dropped to between 98° and 99°, and remained there throughout the remainder of convalescence. There was no vomiting except immediately after the operation.

The stools contained blood and mucus on the second postoperative day, and mucus but no more blood from the third to the ninth day. After this the stools were normal. There was no postoperative distention.

He was discharged on the fifteenth postoperative day with his wound healed by primary union.

CASE REPORTS BY DR. J. J. VALENTINE*

NEW YORK

BILATERAL RENAL CALCULI

MRS. S., aged fifty-six, admitted to Polyclinic Hospital on Dec. 27, 1926. The interesting points in her history are that she had gastrointestinal symptoms for ten years, and especially for the past four years. She lost 18 lbs. weight during the last four years. Urinary disturbances for twenty years. Voids

Examination. There was tenderness on deep palpation over right kidney anteriorly and posteriorly; kidney palpable.

Cystoscopy. Bladder negative except for slight congestion of trigone. Both ureteral orifices normal. Both ureters were catheterized with #7 F. roentgen-ray catheters, meeting no obstruction. Specimens collected and their examination resulted as follows:

	Amount	Appear.	Albumen	Pus	Blood	P.S.P.
Right	20 c.c.	Hazy	Heavy trace	Very numerous	Moderate number of R.B.C.	Trace in 20 min.
Left	10 c.c.	Clear	None	Occasional cell	None	10 per cent in 6 min.

urine three times at night; during the day every three hours. No dysuria. No history of renal colic.

Chief Complaint. Dull ache right lumbar region for past two months. Marked constipation; fever at times. Recently pain radiated downward and anteriorly along course of ureter.

Roentgenogram and pyelogram are herewith submitted. It is interesting to note that no shadows could be made out in the patient's left kidney in any of the pictures taken. Not until her left renal colic, four weeks after right nephrectomy, was it possible to identify the small shadows and then with difficulty.

Operation. Right nephrectomy performed

*Read before Genito-Urinary Section, New York Academy of Medicine, May 16, 1928.

December 31, 1926. No difficulty encountered at operation.

Postoperative History. Patient had a slow

a few times and went into anuria again that afternoon.

Cystoscopy was again performed and roent-

FIG. 1. Prior to operation, showing calculus in right kidney.
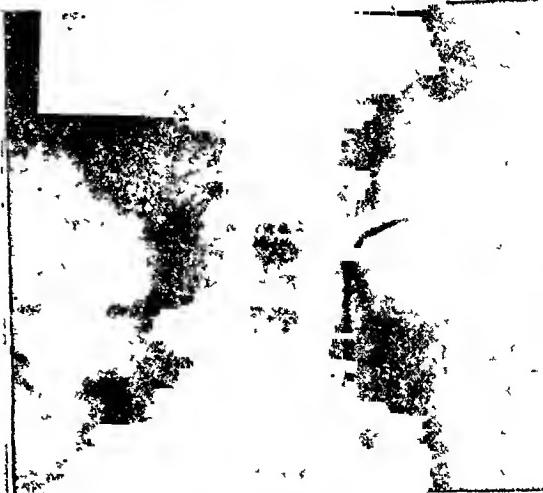
FIG. 2. Showing small shadow at tip of catheter and another above it. Left kidney. Complete anuria.

convalescence because of general run down condition; she developed a cold, tonsilitis, and some sinus infection, which gradually cleared up. The patient was about ready to go home, when on January 24, 1927, she complained of pain and distress in her left kidney region, together with abdominal distention by gas, general malaise, and she vomited. Her intake of fluids for the preceeding six hours before the onset of these symptoms had been about 1150 c.c., and her output of urine was recorded as only 2 oz. Her left kidney was now palpable, and definite resistance was met on pressure. She became progressively worse and went into complete anuria. Repeated attempts to recover urine from her bladder failed, and there was no urine recovered for a period of nine hours.

An emergency roentgenogram was taken at 8 P.M. on the evening that she became so ill and at cystoscopy a catheter was inserted into her left ureter and 2 c.c. of bloody urine collected. The tip of the catheter met with an obstruction at about 20 cm. and after repeated irrigations through the catheter we failed to obtain a normal drip. After much coaxing, the catheter tip seemed to slip into the pelvis of her kidney, and 16 oz. of urine was obtained in a steady drip. Kidney was then irrigated and catheter left in situ. The catheter dripped well and during the night the patient voided urine. On the following day the catheter was removed. She voided scanty amounts of urine

genograms were taken. Her ureter was again catheterized and 10 oz. of urine obtained. Catheter left in for drainage. It drained well and patient voided urine. The catheter was left in place for twenty-four hours and then removed. The foot of the bed was markedly elevated in the hope that the calculi might lodge in the kidney pelvis.

The patient continued to void scantily for several hours, but at 2 A.M. on January 28th, she had a chill and her rectal temperature rose to 107°F.

One more attempt was made to dilate her ureter with the hope of enabling her to pass the smaller of the two stones, but it was found at this cystoscopy that the small stone had passed the ureteropelvic junction and was now firmly wedged in the ureter (Fig. 7); the larger stone appeared free in the kidney pelvis. The ureter was evidently completely blocked as no urine was obtained at this seance. The catheter was left in the ureter to the point of obstruction, and the patient was taken to the operating room at 3 A.M.

Pyelotomy. Left lumbar, oblique and curved incision was made exposing a large, congested and distended kidney full of urine. The pelvis was also found markedly distended. A stone was felt to be free in the pelvis. Another smaller stone was felt just below the ureteropelvic junction where the ureter was very narrow. The pelvis was opened by a small verti-

FIG. 1. Showing catheter coiled up in large pelvis in contact with calculi.

FIG. 2. Pyelogram. Total content of pelvis 70 c.c.

cal incision and urine spurted from the kidney several inches above the field of operation.

The force of the spurt of the urine carried with it the stone that was free in the pelvis, and it was recovered from the wound. The smaller stone was stripped upward from the ureter into the pelvis and recovered. The pelvis was not sutured. The kidney was dropped in place, soft rubber tube to pelvis for drainage and two large cigarette drains laid alongside of it. Muscles approximated with chromic and skin with silkworm gut.

Postoperative History. Recovery was slow but uncomplicated.

Notes. This patient has been seen about every two or three months since the last operation, and repeated roentgenograms show no evidence of stone in her kidney. Function is good, and her urine still shows a light growth of colon bacillus on culture. She was last seen in January, 1928, and her general health is very satisfactory.

RENAL CALCULI IN AN INFECTED HYDRONEPHROTIC SEGMENT OF A HORSESHOE KIDNEY*

R D., Male, aged thirty-eight, first seen in August, 1922.

Chief Complaints. Bilateral pain in lumbar region especially on left side, burning urination, malodorous urine and a constant feeling of soreness in deep urethra.

Past History. Venereal negative. As a child had attacks of frequency and burning urinations. Severe attack fourteen years ago lasting one week.

Present History. Six months ago was in bed over week with frequent urinations, severe pain in left kidney region and hematuria. Three months ago, similar but milder attack. One month ago, blood clots in urine. No loss of weight.

Physical Examination. Well built, strong but pale individual, weighing 160 lbs. Heart and lungs negative. Kidneys were not palpable but pain was elicited on deep pressure over left kidney anteriorly. His external genitals as well as his prostate and seminal vesicles were normal.

Voided urine was cloudy from pus and was malodorous. Urine analysis showed specific gravity 1020, urea normal, phosphates increased, albumen heavy trace. Microscopy showed crystals of triple phosphates in moderate numbers, abundant red blood corpuscles,

pus corpuscles in moderate numbers, a few hyaline casts, Gram negative bacilli, and no acid-fast bacilli.

Cystoscopy. Bladder normal except for trigonitis. Right ureteral orifice normal; left large, puffed and showed encircling erosion of mucosa. Both were catheterized and specimens collected for examinations.

age. Many abnormal blood vessels encountered. Inspection showed a very large, thin sac, which was the pelvis, situated on the anterior portion of the kidney. In attempting to free the lower pole, it was found that this kidney was fused with its mate on the opposite side. The isthmus was about 1¾ inches in breadth and about ½-inch in thickness. Incision was

	Amount	Appear.	S. Grav.	Albumen	Urea	Pus	Blood	Bacteria	Crystals	Indigo Carmine
Right	10 c.c. normal drip	Clear	1015	No appr. amount	1.5 per cent	Scanty	Scanty	None	None	7¼ min. good concentration
Left	50 c.c. steady flow	Cloudy	1016	Distinct trace	1.5 per cent	Mod. nos.	Mod. nos.	Many gram-neg. bacilli	Trip. phos. and small concretions	12 min. pale green, watery

Phenolsulphonphthalein (1 c.c. intramuscularly) 1st hour—45 per cent. 2nd hour—20 per cent. Total—65 per cent.

Phenolsulphonphthalein (1 c.c. intravenously):

	Appearance	Am't Collected	Percentage
Right	5 minutes	10 c.c.	15 per cent in 10 minutes
Left	20 minutes	30 c.c.	Faint trace only

Blood Chemistry.

Urea-nitrogen .... . 22.4 mg. per 100. c.
Non-protein nit.. .. 36 mg. per 100. c.
Creatinine ... . 3.2 mg. per 100. c.

Roentgenograms and pyelographic studies are herewith submitted. It is of interest to know that 70 c.c. of sodium iodide solution, 20 per cent, was used to fill completely the left kidney and pelvis (Figs. 1, 2).

Preoperative Diagnosis. Calculi in infected hydronephrosis of left kidney.

Operation. September 9, 1922. Gas-ether anesthesia. Left lumbar incision, down to and exposing fatty capsule of kidney, which, when broken through, exposed kidney easily. Many adhesions were broken up, especially at upper pole. First view of kidney showed it to be lobulated; on palpation kidney felt like a saus-

Fig. 3. Roentgenogram of left segment of horseshoe kidney removed by hemi-nephrectomy. Shows calculi, a very large pelvis and isthmus.

extended downward and forward, and a hemi-nephrectomy performed. Isthmus was clamped and cut margin sutured with a continuous cat-gut, running suture. No hemorrhage from the remaining kidney. Wound closed in the usual fashion, interrupted chromic to muscles; silk-worm gut to skin. Large cigarette drain in lower angle of wound.

Specimen. The specimen, which represents the left half of the horseshoe kidney, is herewith presented (Fig. 3.)

This patient was seen one month, four months and six months following his operation and again this evening, which is about six years from the time of his operation, and apparently he is enjoying good health.

MALIGNANT ADENOMA OF THE THYROID GLAND*

LOCKE L. MACKENZIE, M.D.

NEW YORK

DURING the past fifty years tumors of the thyroid gland have given rise to a great deal of discussion, and in no class of tumors has the discussion been pursued with so many conflicting conclusions as in the so-called "benign metastasizing adenoma," perhaps more aptly, the malignant adenoma. It is because of the paucity of cases reported from American clinics as well as the somewhat unique clinical features of this particular case that it was considered sufficiently interesting to be worthy of record.

No attempt will be made to summarize the literature on this subject, but it would be difficult to understand some of the conclusions drawn without mentioning a few of the outstanding points in the history of the problem. The great majority of case reports as well as most of the theories which have been formulated to explain the metastasis of thyroid adenomas come from the Continent, and it is to the German and French investigators that we owe most of our knowledge of this subject.

Apparently it was Müller[1] who in 1871 first emphasized the benign histological character of certain nodules of metastatic thyroid tissue. Five years later Cohnheim[2] reported his now famous case. This case has always attracted great attention as there were numerous metastases throughout the skeleton with what was at that time con-sidered to be an entirely benign thyroid gland. In any event, following it the literature began to contain many a report dealing with this question. In 1883 Wölfler[3] made the statement that when metastases grow and destroy bone the primary tumor should not be considered benign even if its malignancy cannot be detected histologi-cally. When the ectopic anlagen theory came into prominence it was argued that these thyroid metastases were due to dis-placed islands of embryonic, fetal, glandu-lar tissue, the "wucherende struma" of Langhans. This theory might indeed satisfy those cases in which the secondary growth occurred near the site of the thyroid (in the neck, about the sternum, clavicle, etc.) but it could scarcely explain those in which metastatic nodules were noted far from the original organ.

Von Eiselsberg[4] pointed out that about one-half of the secondary growths were found to be single at autopsy, so that surgical intervention was indicated if it were possible to reach the site of the metastasis. Contemporary surgeons, how-ever, attacked this stand on the basis of the general knowledge of the nature of metastases which are usually multiple. The rationale of treatment was, in the closing years of the last century, largely a matter of personal opinion, with poor statistics to help.

In 1910 Walther[5] used radium therapy, a type of treatment then in its infancy; his results were, as might be expected, poor. As soon as the roentgen ray came into prominence it was used with, however, much better results on the primary than on the secondary tumors. With the perfection of technique in this field results were more encouraging (Soiland,[6] Ginsburg.[7]) In fact, in the latter's excellent paper, the author stresses the radiosensitivity of metastatic thyroid growths, quoting 2 cases to support his contentions. This paper contains a full review of the literature.

Until the painstaking work of Graham[8] which appeared nearly four years ago, there was no very clear-cut idea of the pathology of that type of thyroid neoplasm which, acting as a cancer in its systemic dissemination yet appears so benign microscopically. Graham states at the outset that any thyroid is malignant if it gives rise to metastases, regardless of its appearance. In this view Bell[9] joins him. In the pathology of the type of tumor which gives rise to metastases Graham deprecates the importance of the histopathology of the cells themselves. Rather he stresses recurrence, metastasis, invasion of the capsule, and, in particular, invasion of the thyroid veins as the only real criteria of malignancy. This last feature Graham demonstrated in all the cases from the rich surgical material of Crile's Clinic in Cleveland. Subsequent observation showed such tumors to be malignant adenomas, as they either recurred or metastasized. In retrospect, it might be well to mention that both in Cohnheim's original case, and in others of the older reports (Middeldorpf[10]) venous invasion was noted in the thyroid, although the neoplasm was considered benign.

It is therefore most difficult to say whether many of the previous cases were benign from Graham's point of view, due to the lack of specific observation of this one point of venous invasion. Oderfeld and Steinhaus,[11] Coats,[12] Kanoky[13] Flatau and Koelichen,[14] and Halbron,[15] as well as many others, report instances of thyroid

glands which have given rise to metastases, while histological examination of the primary tissue revealed no evidence of malignancy. Simpson,[16] however, has gathered 77 cases from the literature and concludes that "no single case in the literature offers complete and convincing evidence of the innocent character of the tissue from the thyroid gland or its metastases." For a more complete review of the subject, as well as an admirable discussion, the reader is referred to the papers of Patel,[17] Wilson[18] and Ginsburg.[7]

The case to be reported is of interest in that it is the first case, with one exception to be quoted later, of which the author has been able to find record in which thyroidectomy was done before operation on the secondary tumor. In this instance the true origin of the metastasis was suspected, and histological section of the thyroid was carefully examined for evidences of malignancy; as none were found, it was concluded that the secondary tumor was independent of the thyroid, exploration was performed, and histopathological study showed a typical thyroid adenoma.

CASE REPORT

M. S., an American widowed housewife, aged fifty, white, entered the New York Post-Graduate Hospital November 28, 1927, complaining of the following symptoms: Difficulty in walking, with swelling of the ankles for ten to fifteen years; frequency in urination for 2 years; inability to walk for one month.

Her past history was negative except for the following points: she had had frequent headaches one year ago, relieved by glasses; she had had a goiter for many years, but had noted no recent increase in size; she had had dyspnea on exertion for many years, but she attributed this to obesity; occasional diarrhea was complained of, the last attack two weeks prior to admission; she had had regular nycturia 1 to 2 times a night for five years, and was told three years ago that she had pus in her urine. Her menopause was not yet established.

Her present illness dated back ten to fifteen years when she began to have difficulty in walking. This difficulty gradually increased.

For six months before her admission she noted numbness in the legs and a feeling of deadness in the soles of the feet. In fact, it was necessary for her to look at her feet in order for her to know where they were. She became unsteady, and for the previous month had been unable to walk at all. She was now having nycturia 3 to 4 times each night, with inability to retain her water at times. For the past six months she had had pain in the left lumbar region radiating to the mid-line under the left breast.

Physical examination on November 28, 1927 disclosed a very obese, plethoric, slightly cyanotic and orthopneic individual. Marked pulsation of the carotid arteries was present. The thyroid was enlarged, measuring about 12 cm. across. It was fairly hard and smooth except for a cystic feel of the right lobe, which was perhaps a little larger than the left. A tracheal tug and a faint bruit were present. The lungs were negative. The heart was enlarged in all diameters, with the point of maximal impulse in the 5th space 14 cm. to the left of the mid-sternal line. Apical and conus systolic murmurs were heard; rate 104; rhythm regular. Blood pressure 130/60. The peripheral arteries were not thickened. The liver edge was felt just below the costal margin. Slight edema of the ankles, many varicosities, and scars of old varicose ulcers were present.

On the same date neurological examination disclosed the fact that the patient was unable to turn over in bed while lying on her back with legs extended; nor could she rise to a sitting position without help. Slight intention tremor of the upper extremities and some dysmetria was present. Adiodokokinesis was noted, more marked on the left. The deep reflexes of the upper extremities were diminished and equal; those of the lower extremities were increased. There was bilateral ankle clonus, but no patellar clonus. A bilateral Babinski was noted and confirmed. The abdominal reflexes were absent. There was no atrophy of the musculature, but there was a flaccid paresis of both legs, more pronounced on the left. The right leg, but not the left, could be flexed a little at the knee, and the right foot could be moved off the bed. Abduction and adduction was not possible with either leg. Dorsiflexion and dorsi-extension of the right foot was possible but weak, while neither movement was possible with the left. Electrical reactions showed responses in both legs to the faradic current with 55 milliampères; galvanic stimulation showed no reaction of degeneration and a normal response.

The cranial nerves were negative. The eye grounds showed moderate arteriosclerotic changes.

Sensory examination showed a level corresponding to the 6th and 7th dorsal segments, with greater loss of pain on the right side, and a greater diminution to tactile sensation on the left. Muscle tendon sense was lost in the toes on both sides, while vibratory sense was absent as high as the iliac crests on both sides.

Examination of the urine was negative. Blood examination showed: hemoglobin 90 per cent (Sahli); red cells 4,700,000; white cells 7,500 with 72 per cent polymorphonuclear leucocytes, and a normal differential count. The blood chemistry was normal, and the icterus index was 5.5. The Wassermann reaction of the blood and spinal fluid was negative. The spinal fluid was clear, contained a trace of globulin by Noguchi's butyric acid method, and 2 cells, both lymphocytes. Manometric studies of the spinal fluid suggested a partial block. The colloidal gold curve was 0111000-00-0. Gastric analysis showed the presence of free HCl. The basal metabolic rate four days after admission was plus 49 per cent.

The diagnosis of colloid goiter was made, and the possibility of a metastatic thyroid tumor to the spine was considered. As the patient's general condition was poor it was not thought that she would be able to undergo a laminectomy at this time, and a surgical consultation as to the advisability of thyroidectomy was sought. The surgical consultant advised thyroidectomy, emphasizing that this clinical type of goiter rarely metastasized, and an independent cord lesion was assumed.

As a preliminary to operation, the patient was placed on phenylethylbarbituric acid (grains 3 a day) and quinine hydrobromide (grains 15 a day). Iodine was considered to be contraindicated as the high basal metabolic rate indicated the possibility of a toxic adenoma being present in the goiter. Seventeen days later the basal metabolism was reduced to 32 per cent above normal, and thyroidectomy under ethylene anesthesia was performed by Dr. Charles Gordon Heyd. At operation it was noted that the right lobe of the thyroid was diffusely enlarged. Operation consisted in complete resection of this lobe which was well encapsulated. Recovery was good and exceptionally rapid.

Pathological examination by Dr. Ward H. Cook follows:

Tissue specimen No. 33704.

There is no definite lobular arrangement. The stroma is scanty and edematous. Hemorrhagic areas are seen (Fig. 1).

Fig. 1. Adenomatous goiter. (Struma nodosa microfollicularis.)
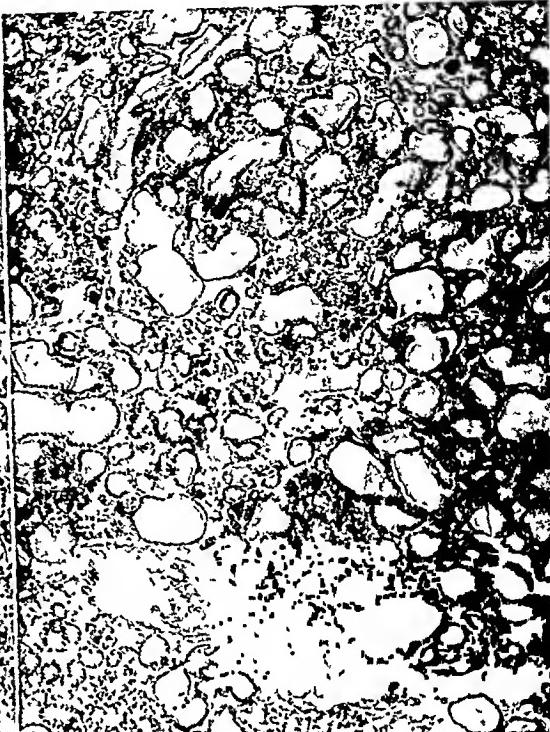
Fig. 2. Growth of vertebra. Metastatic adenoma of thyroid. The metastatic adenoma is more cellular than the primary growth. There are no mitotic figures.

Gross. Specimen is a cystic thyroid, 10.5 × 6.5 × 3 cm. On section the surface is hemorrhagic and edematous with fibrous encapsulation. Toward one pole of the mass are two small tumors, the larger measuring 2.5 × 3 × 1.5 cm. There is a small area of calcific deposits in the wall of the cystic mass.

Microscopic. Section from the wall of the cystic mass shows a thin but definite fibrous capsule with a small amount of thyroid tissue adherent to the outer side. Attached to the inner surface of the capsule is a highly edematous often hemorrhagic stroma supporting numerous small vesicles lined by low epithelial cells and filled with colloid. There are also indefinite groups of solid cell cords without lumen. Associated with the hemorrhage are masses of brown granular pigment contained within large mononuclear cells. Sections from the smaller solid tumors show them to be composed of vesicles resembling those of the thyroid gland. These vary greatly in size, some being small and without lumen; others lined by low epithelial cells are filled with more or less vacuolated, sometimes granular colloid.

Diagnosis. Multiple adenomata of thyroid with retrograde changes.

As there was no evidence of malignancy exploration of the spine was now determined upon, the more so because the neurological symptoms were rapidly progressing. By this time, three weeks after admission, all power of motion was lost in both legs. The deep reflexes in the left lower extremity were greater than in the right, and there was transient left suprapatellar and ankle clonus. There was bilateral spasticity of the legs, more on the left. Basal metabolism taken two weeks after thyroidectomy showed a rate of 16 per cent above normal, and the patient's general clinical condition was much improved.

On January 4, 1928, laminectomy was performed under local anesthesia by Dr. Byron Stookey. At operation the following findings were noted:

Bilateral laminectomy was done with the 5th thoracic vertebra at its center. The arches of the 3rd, 4th, 5th, 6th, and 7th were removed.

On coming down to the dura on the left side opposite the 7th thoracic segment and beneath the 5th thoracic vertebra a round vascular protrusion, blood-red in color, was encountered. This had eroded the bone so that the vertebral arch on this side was thinner than on the opposite side. The pressure exerted by the tumor must have been considerable, since marked protrusion of the tumor occurred as soon as the bone was removed. The tumor extended laterally somewhat, and was found invading the 4th, 5th and perhaps the 6th thoracic vertebrae. Hemostasis was fairly well established by packing with hot gauze, and a fairly thorough removal of the tumor was accomplished. The area still remaining was carefully cauterized with Zenker's solution. The dura was smooth and glistening; upon being opened, no extension to the cord was noted. The cord itself appeared whitish and seemed somewhat narrower than usual. The immediate diagnosis was primary sarcoma of the vertebra.

Pathological examination by Dr. Nicholas M. Alter follows:

Tissue specimen No. 33818.

Gross. Specimen consists of a number of soft and bony pieces weighing together about 10 gms. The soft pieces range from 5 to 20 mm. in diameter. They are firm in consistency, rather translucent, with some hemorrhagic foci. They do not suggest any normal tissue structures. The bony pieces are partly covered with some smooth cartilage, and consist of some spongy bone which also contains some of the gray growth-like tissue.

Microscopic. Sections show a glandular growth of small acini. These are lined by one layer of low cuboidal cells. Most of them contain pink-stained colloidal secretion. The lumina of some acini are quite narrow. The stroma is considerable in amount in places and contains free epithelial cells. There are, however, no mitotic figures. The cells are all well differentiated. Some of the acini contain hemorrhagic secretion. Some hemorrhage is also seen in the stroma (Fig. 2).

Diagnosis. Metastatic adenoma of thyroid in vertebra.

A transfusion of 500 c.c. of whole blood was immediately given postoperatively on account of rather profuse hemorrhage encountered during the procedure, and convalescence was uneventful and rapid. Two weeks later the patient was discharged to go to the Memorial Hospital for radium therapy. At the time of her discharge there was some slight return of motion in the right leg. At the Memorial Hospital she was given 12,000 millicurie hours of radium emanation at a distance of 6 cm. over the 3rd and 4th thoracic vertebrae in divided doses as follows· January 22, 1928, 6,000 millicurie hours; January 26, 1928, 4,000 millicurie hours; January 28, 1928, 2,000 millicurie hours.

She then left the hospital and returned to her home, still with very limited motion in her lower extremities. Four months later (May 9, 1928) the patient was much improved having a great deal of motion in both legs, and able to get about the house on crutches. At this time she could even take a few steps without crutches.

On a later visit with the patient, November 1, 1928, almost a year after her admission to the Post-Graduate Hospital she was found to be in excellent health. She had gained 20 to 30 lb. a circumstance possibly due to her thyroidectomy. She complained of no subjective symptoms, and said that she felt better than she had for years.

Physical examination disclosed many points of interest. The thyroidectomy and laminectomy scars were perfectly healed, were not tender, and were not adherent to the skin. Motion of the spine was present normally in all directions. Her gait was normal. She could walk up and down stairs without help. Muscle strength was good and equal in the legs, feet and toes.

There was no dysmetria or ataxia, but there was a slightly positive Romberg sign. The deep reflexes were normal and equal in the upper extremities, while the suprapatellar, patellar and Achilles reflexes were present on both sides, slightly but definitely more active on the left. There was no clonus, and bilateral plantar flexion was present.

The sensory examination disclosed that superficial touch, pain, and muscle-tendon senses were normal and equal in both lower extremities. There was, however, a slight persistence of the old sensory level on the trunk, although it was much less definite than before operation.

The patient now goes about everywhere, enjoying a freedom of motion and a lack of restrictions which she has not experienced for some years.

It would seem that this case illustrates well several points frequently encountered

in metastasizing adenomas of the thyroid. From the standpoint of sex incidence it should be emphasized that the patient was a woman. At the Mayo Clinic 69 per cent of the cases were in women; while Müller and Speese[19] report 60 per cent. Patel[17] stressed the fact that this type of goiter does not usually enlarge while causing metastases, an occurrence one so often sees in the frankly carcinomatous transformations. Throughout the literature one often finds warnings not to overlook the possibility of a malignancy of the thyroid, when tumors of thyroid and bone are encountered in the same patient. For reasons enumerated above, a preliminary thyroidectomy was done in this case, but even with all the resources of careful microscopical study, no evidence of malignancy could be demonstrated. Wilson[18] has stated that the type of tumor which ceases to proliferate and gradually degenerates tends to be "benign" in the sense that it does not invade surrounding structures, and does not metastasize. Yet this thyroid gland was undergoing retrograde changes, and did metastasize.

In one other case quoted by Patel[17] there was reported an examination of the thyroid gland before the secondary tumor was excised. Subsequently, however, this thyroid became obviously carcinomatous.

The clinical results in this case seem to justify the radical conception of attempting to excise surgically a malignant metastasis. What the eventual outcome of the patient will be is, of course, highly problematical. In a comparatively short period, however, she has recovered so far that she is able to enjoy a degree of motion and action impos-

sible for six to eight previous months. It may be argued that radium alone might have produced as good an outcome. In the innominate bone, in the sacrum, and in the skull excellent results have been reported with the sole use of the roentgen-ray but in these situations the tumor was much more superficial than in the present case.

Summarizing then, a case is reported of a woman with a colloid goiter containing two small adenomas, and presenting signs and symptoms of compression of the spinal cord. Thyroidectomy was done. There was neither clinical nor pathological evidence of malignancy judged by any criteria which have as yet been noted. Laminectomy was later performed. In this secondary tumor again no evidence of malignancy could be established under the microscope. Postoperative radium therapy was given, and a short time later the patient was much improved. A few of the more important references to the subject have been included, and a short discussion of the present case in relation to other more or less similar ones is appended.

CONCLUSIONS

1. It is not always possible to recognize the malignancy of an adenoma of the thyroid by either clinical or pathological study.

2. Surgical intervention to excise a metastatic thyroid tumor is sometimes justifiable.

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CASE REPORTS BY DR. HERBERT WILLY MEYER

NEW YORK

EPITHELIOMA OF RIGHT SUPERIOR MAXILLA*

A MAN of fifty-two, born in Porto Rico, was admitted to Dr. George H. Semken's service at The New York Skin and Cancer Hospital on August 25, 1927.

He had had a sore on the alveolar border of the right upper jaw which had caused some pain for the two months previous to admission. The teeth in this region had dropped out by themselves.

Examination of the mouth presented the whole story of the development of an epithelioma. He had various areas of leucokeratosis, precursors of cancer, and at the site of the ulceration a papillomatous growth which had turned into an epithelioma. The Wassermann reaction was negative, and he gave no history of specific disease. The characteristic appearance of the lesion and its rapid onset and growth confirmed the diagnosis of epithelioma. Resection of the right superior maxilla was indicated.

My purpose in presenting this patient is twofold. First to show the cosmetic result of the type of incision used, and secondly to draw to your attention the method proposed by

* Presented before Section of Surgery, New York Academy of Medicine, March 2, 1928.

Dr. Semken, of temporarily angulating the external carotid artery during the operation so as to save blood, and also conserve full blood supply to the flap for healing purposes.

The operation was performed on August 30, under 5 oz. of ether-olive oil colonic anesthesia, the ideal anesthesia in our experience for this type of case. The incision for placing the ligature around the external carotid artery was made about 1 in. long at the level of the hyoid bone along the anterior border of the right sternomastoid muscle. The sheath of the sternomastoid muscle is nicked and the incision deepened until the internal jugular vein is seen. By tearing through the thin fascia just *below* the junction of the common facial vein with the internal jugular vein one comes down onto the bulge of the common carotid artery just before it divides into internal and external branches. The first branch of the external carotid artery is seen, the superior thyroid artery and the external carotid artery are completely freed just above this point. The best instrument for this is a grooved director, and then a heavy catgut ligature, single or double, is placed around the artery with a Valentine Mott ligature carrier, an excellent instrument for this purpose. Heavy catgut is advisable so as not to injure the artery or its intima when pulling on the ligature. This

catgut ligature is not tied and a hemostat is placed at its end. The wound is sutured. The sheath of the sternomastoid is closed with interrupted fine chromic and the skin is sutured with fine interrupted black silk. As soon as the incision for the resection of the superior maxilla is begun the second assistant angulates the external carotid artery by gently pulling on the catgut ligature and during the operation the operative field bleeds very much less, as no blood can enter from the external carotid. It is important to place the ligature above the superior thyroid artery as there is a large anastomosis between the two superior thyroids from either side of the neck. At the end of the operation the catgut ligature is cut close to the skin with a clean scissors and this at once restores the normal circulation and the skin flap has its full blood supply for good healing. This little procedure as proposed by Dr. Semken and used on his service is excellent and highly recommendable for various procedures in which formerly the external carotid artery has been permanently ligated.

The incision as used on our service is made from a point just below the inner canthus of the eye downward along the side of the nose, around the ala of the nose to the midline and then downward directly through the entire thickness of the lip. This incision is deepened to the bony structures and the flap is dissected outward by pushing the structures with a raspatory. As much of the mucous membrane is saved as possible, depending on the proximity of the cancer and its encroachment onto the buccal mucous membrane. The pyriform opening is well exposed and with this type of incision the entire outer surface of the superior maxilla is accessible. If necessary an additional incision can be made horizontally outward from the upper point of the incision along the inferior orbital margin. The mucous membrane of the nose is then most carefully separated from the floor and outer bony wall of the nose and then the usual bone sections are made. As much of the floor of the orbit is saved as possible in order to prevent the annoying dropping of the eye. In this case this was possible as the lesion did not extend upward.

After the superior maxilla had been thus removed the raw surfaces were cauterized with the hot cautery as used on Dr. Semken's service in order to destroy any possible cancer cells and also make a thin eschar which will prevent absorption from the raw surface. An iodoform gauze packing was then placed in the defect, held in place with black silk sutures and the flap returned in place and most carefully sutured. The most important suture, the first to be placed and the last to be tied, is the one directly at the vermilion border of the lip. With this patient very little deformity was visible after the resection of the jaw. The pathological examination showed the tumor to be a prickle-cell epithelioma.

After complete healing has taken place a denture can be made to close the opening in the region of the hard palate if the patient is annoyed in swallowing or if difficulty in talking is experienced. Dr. Edward Kennedy, the consulting dentist of the Skin & Cancer Hospital has made most ingenious dentures for these cases composed of upper and lower plates joined at the posterior end with a spring which automatically holds the plates apart. As the mouth is opened the plates come apart and the upper one keeps the opening in the upper jaw closed. When the patient closes the mouth he does so against the spring action. In this way the upper plate is continuously held against the upper jaw and the patients are most comfortable and are well able to talk and eat.

DISCUSSION

Dr. Howard Lilienthal. There is a question whether the full return of circulation is advisable in these cases. A number of years ago a prize essay was written by the late Dr. R. H. M. Dawbarn in which he discussed the treatment of certain inoperable cases of malignant growth of the face and jaw by extirpation of both external carotids with ligation of all the branches up to the internal maxillary. His theory of starvation of the growth was based on good physiology. It has been shown that malignant growths necrose before the healthy structures when the blood supply is cut off. I believe that if I had to operate on a case like this one I would extirpate the external carotid and then do the operation under a permanent instead of a temporary ischemia.

Dr. Meyer (in closing). I agree with Dr. Lilienthal that ligation of main arteries in inoperable cancers is a wise procedure. It starves the tumor and retards its growth. If a cancer is operable, however, radically removable with proper cancer technique, and the tumor is removed in toto, then ligation of the

artery is of no value. If a reconstruction operation has to be added, it is of the greatest value and benefit to have the full blood supply entering the operative field at the completion of the operation. This important point was demonstrated in the case presented. Ischemia was brought about by the temporary angulation of the external maxillary artery instead of permanent ligation.

SPLENECTOMY OF GUNSHOT WOUND OF SPLEEN

A YOUNG man of twenty-six was admitted to the service of Dr. Carl Eggers, at the Lenox Hill Hospital, during the night of May 8, 1927. He had been shot five times and roentgen-ray examination showed that one of the bullets had penetrated the complementary space of the left pleural cavity and had then entered the abdomen through the diaphragm and passed through the 12th rib posteriorly and was lying just under the skin in the region of the spleen.

There was evidence of injury to some intra-abdominal organ. The kidney could be ruled out and a diagnosis was made of injury to the spleen with hemorrhage or possibly injury to the colon. Immediate exploratory laparotomy was indicated.

It was found at time of the operation that there was a tear of the posterior surface of the spleen which was small and very high up in the vault of the diaphragm and covered by a much distended stomach. Access to the pedicle was difficult. Therefore in order to get better access the left costal arch was turned up according to the technique as advised by Marwedel and used by Dr. Willy Meyer in New York and published by him in 1906. This immediately gave most excellent access and the splenectomy was very simple.

The patient made a somewhat stormy convalescence on account of the infection of the abdominal wound with Staphylococcus albus, probably carried into the abdomen with the bullet. During convalescence the remaining bullets were removed under local anesthesia.

The patient is now in excellent condition except for a weakness in the abdominal wall for which he is wearing an abdominal supporter.

DISCUSSION

DR. WILLY MEYER: I would like to say just a few words in regard to resection of the costal arch. If one has to operate within the dome of the diaphragm it is best that one can see what is going on. It is an advantage to have the exposure made by dividing farther downward the tissues already in front of the operator, making a large skin-muscle-cartilage-flap and turning that then well up and outward. Then the surgeon can clearly see what he is doing.

CASE REPORTS BY DR. J. WILLIAM HINTON*

NEW YORK

EXOPHTHALMIC GOITER (2 CASES)

CASE 1. W. H., male, admitted to Post-Graduate Hospital June 27, 1923.
Chief Complaint. Swelling of neck.
Family History. Mother has had a goiter for forty-five years.
Past History. The usual childhood diseases. Scarlet fever when seven years old. No surgical operations. Venereal disease denied. Bowels regular. No urinary disturbances.
Present Illness. Patient stated he had had an enlargement of his neck for several years but for the past eight or ten months he had lost weight, about 40 to 50 lbs. His eyes were enlarged and he was extremely nervous. Had palpitation of the heart. Had been told he had a goiter but was advised against operation. Chief complaint at this time was pain in his back. Stated that he had had this for the past two years. Had been unable to work due to the pain in his back and the goiter. Roentgenograms had been taken. Had worn a brace and belt without relief. His chief desire was to obtain relief from his back and not from his goiter.
Examination. Patient was a well developed and nourished man, thirty-one years old.

* Read before Section of Surgery New York Academy of Medicine, March 2, 1928.

Eyes revealed a definite exophthalmos. Neck; an enlargement over the thyroid region with a definite thrill over same. Pulse 120 and a definite tremor of fingers. Patella reflexes exaggerated. Examination of back did not reveal any muscle spasm or limitation in bending. No external evidence of disease to the lumbar vertebra.

Diagnosis. Exophthalmic goiter. Roentgenograms of the lumbar and sacral regions of the back were reported negative. Wassermann negative. Patient was advised to have the goiter treated and the back symptoms would probably disappear.

Admitted to Post-Graduate Hospital June 27, 1923. Basal metabolism taken June 28 was plus 27. Wght. 156 lbs. Patient was put on luminol grains 1½, Lugol's solution mm. 7, ovarian substance grains 3, pancreatic substance grains 2, Q. 4 H.

Operation, July 2, 1923. Under gas oxygen ether anesthesia. Low collar incision was made, skin flaps dissected up, muscles separated in midline, clamped and the sternohyoid and sternothyroid muscles were divided. The right lobe, was delivered, capsule dissected off and practically the entire lobe removed, leaving a small amount of tissue at the superior pole. Same procedure carried out on the left side, leaving a small amount of tissue at the superior pole. Muscles sutured with No. 2 plain catgut, skin, with silk. Rubber tissue drain inserted.

Follow-up, July 15. Patient stated that since operation he had no complaints referable to his back. He left his belt when he left the hospital. Wound had a slight serous discharge. Pulse 120.

July 25. Sleeping and eating well.

Aug. 2. Stated that he felt much improved since operation. He had gained 5 lbs. in weight and was anxious to return to work. Advised to wait until August 15.

Aug. 15. Returned to work on August 15, 15 lbs. heavier than before operation. Sleeping well. Pulse 96. Did not tire easily.

Oct. 10, 1924. Basal metabolism minus 7. Patient 40 lbs. heavier than before operation. Stated that he had worked ten to twelve hours a day for the past year. Felt perfectly well.

May 9, 1927. Patient stated that he had not lost any time from work since operation. Blood pressure 120/80. Pulse 76. Weight 180.

CASE II. G. S., female, admitted to Post-Graduate Hospital May 10, 1927. *Chief Complaint.* Patient was first seen on May 3, 1927, complaining of swelling of her neck, nervousness and enlargement of eyes.

Past History. She had never had any serious sickness or surgical operation. Had had whooping-cough and measles. Received a fracture of right tibia in December, 1924. Incapacitated for three months, otherwise in good health with the exception of present complaint.

Present Illness. About November, 1925, when patient was nine years old her mother noticed a slight enlargement of her neck. She had a cold at the time and consulted her family physician who advised taking her to a hospital for examination. She went to a clinic in one of the Metropolitan Hospitals in December, 1925. Was told she was suffering from a goiter and advised to remain in bed at home for two weeks, and given medicine to take. When she returned to the clinic she had lost 2 lbs., then weighing about 55. She did not know her best weight. Was then advised to enter the hospital which she did on December 28, 1925. She remained in the hospital for six to seven weeks. Her tonsils and adenoids were removed at the time. The mother was definitely advised against an operation until the child was fifteen years old. She did not seek further medical treatment until May, 1927. During this time the child did not gain in weight, her eyes became more prominent and she was very nervous and irritable. Did not play with other children because she tired very easily. Had frequent colds and lost several weeks from school at a time.

Examination. Eyes markedly enlarged. Definite enlargement over the thyroid region with a marked thrill over same. Measures 26½ cm. No murmurs or arrhythmia. Blood pressure 140/80. Throat negative. Teeth in good condition. Definite tremor of hands. Patella reflexes exaggerated.

Diagnosis. Exophthalmic goiter and operation advised.

Basal metabolism May 12, 1927, plus 49. Weight 61 lbs. Patient was put on Lugol's solution mm. 5, ovarian substance gr. 3, pancreatic substance gr. 2 and luminol gr. 1, Q. 4 H. Basal metabolism on May 20, 1927 was plus 23, weight 59 lbs. During this time the patient was quite ill and she had diarrhea and incontinence. She ran a temperature ranging from 99°F. to 102°F.

Operation, May 21, 1927. Under ethylene

anesthesia, low collar incision was made. Skin flaps were dissected up, muscles separated in midline. Right lobe was easily delivered. Capsule dissected off. A small amount of tissue was left at the superior pole on the right side. Same procedure was carried out on the left side leaving a small amount of tissue at the superior pole. Isthmus removed. Muscles sutured with No. 2 plain catgut, skin, with silk.

June 3. Slight serous discharge. Wound cleansed, dry dressing applied.

June 6. Wound cleansed. Dry dressing applied. Weight 69¼ lbs.

June 9. Wound cleansed. Dry dressing applied. Weight 71¾ lbs.

June 13. Wound cleansed. Dry dressing applied. Weight 73½ lbs.

June 16. Wound cleansed. Dry dressing applied.

June 20. Wound cleansed. Dry dressing applied.

June 24. Wound entirely healed. Patient cured and discharged. Weight 73¼ lbs. Patient is going to the country and will report upon her return.

Oct. 19. Patient attending school. Had no complaints. Slept well and was steadier and less restless. Weight 79¾ lbs. Pulse 90. Blood pressure 110/80. No tremor of fingers. No thrills over neck.

Feb. 23, 1928. Mother stated that patient had not lost any time from school since September, 1927. Up in her studies and perfectly well. Weight 85¼ lbs. Blood pressure 100/70. Pulse 96. Slight tremor of hands. Reflexes not exaggerated. Basal metabolism plus 9.

ADENOMA OF LEFT VALVE OF THYROID

MRS. E. LeF., admitted to Post-Graduate Hospital May 25, 1925. *Chief Complaint.* Enlargement of left side of neck.

Past History. Patient married and had two children, the oldest two and the youngest one year old. Never had any serious illness or surgical operations. Always been in excellent health with exception of present complaint.

Present Illness. Patient stated that after birth of her first child, two years ago, she noticed an enlargement of the left side of her neck. This gradually increased in size. She had not been nervous, had any choking sensations

or palpitation of heart. She had taken medicine which I assumed was thyroid extract. She was also given some salve which may have been iodex. In December, 1924 basal metabolism was minus 7. Had one roentgen-ray treatment but did not return for more.

Examination, April 15, 1925. Eyes normal. Throat; some tonsil tissue on the right side. Teeth in fair condition. Neck; enlargement more marked on left side of thyroid gland, rather firm but no evidence of thrills. Heart; no enlargement or murmurs detected. Blood pressure 130/80. Pulse 90. No tremor of hands.

Diagnosis. Adenoma of left lobe of thyroid.

Operation, May 26, 1925. Under rectal anesthesia, low collar incision was made. Muscles separated in midline, not divided. Left lobe was enucleated and the adenoma was found to have cystic degeneration. Considerable fluid escaped. All of the left lobe was removed with the exception of a small amount of tissue at the superior pole. About ¾ of the right lobe was removed, leaving most of the tissue at the superior pole on right side. Isthmus of thyroid was removed. Muscles closed with plain catgut, skin, with silk. Rubber tissue drain inserted.

Postoperative. Within eighteen hours after operation patient complained of tingling sensation in hands. Twenty-four hours later she had definite spasms and clonus of hands, with a typical picture of tetany. She complained of pain and tingling sensation in face. Was given calcium lactate gr. 20, Q. 4 H., parathyroid gr. ⅕ Q. 4 H. and thyroid extract gr. 2, t. i. d. Also four doses of calcium chloride gr. 15, intravenously O. D. for four doses. The spasms disappeared after the injections of calcium but returned in a few hours following the first injection. After each injection the patient was free from symptoms for a longer period of time. After the fourth injection patient remained in the hospital forty-eight hours and was entirely free from symptoms.

Follow-up, June 5. Patient still had some tingling sensation in her hands, and occasional tingling sensation in legs. No other symptoms. Otherwise feeling normal. Was advised to continue parathyroid extract, gr. ⅕, t. i. d., calcium lactate, grains 20, t. i. d. To discontinue iodine and return in one week.

June 13. Calcium chloride, grains 15½, intravenously.

July 3. Calcium chloride, grains 15½, intravenously.

July 10. Calcium chloride, grains 15½, intravenously.

July 17. Calcium chloride, grains 15½, intravenously, condition about the same.

July 25. Calcium chloride, grains 15½, intravenously. Still had sensation in legs, although her condition improved.

July 31. Calcium chloride, grains 15½, intravenously. To continue mouth medication as previously prescribed. Felt perfectly normal with the exception of the tingling and numbness in hands and legs.

July 7. Remained about the same. Calcium chloride, grains 15½, intravenously.

July 20. Calcium chloride, grains 15½, intravenously.

July 31. Patient stated she felt better and only had the tingling every few days. Calcium chloride, grains 15½, intravenously. To continue with medication.

Sept. 8. Condition about the same as before stated. Calcium chloride, grains 15½, intravenously.

Sept. 18. Patient had very little discomfort since her last visit. She was given calcium chloride, grains 15½, intravenously.

Oct. 3. Stated that she had not had any discomfort since her last visit and felt normal. She was given calcium chloride, grains 15½, intravenously, and instructed to continue the mouth medication and return at the end of that time.

Feb. 10, 1926. Patient returned stating that she had been free from symptoms since her last visit. Reason of delay, residence far out of town. Will return sooner if she has symptoms.

URETERAL ANASTOMOSIS*

Edward L. Keyes, m.d., f.a.c.s.

NEW YORK

THIS man, when I presented his case last year, had a bilateral kidney tuberculosis of which I did not wish to speak in his presence. I operated on him at Bellevue and removed his left kidney in 1923. His bladder remained as uncomfortable as ever. He had secondary lesions in his right epididymis and a rib. In April, 1927 he was so uncomfortable and sick that I transplanted his ureter into his abdominal wall and performed epididymectomy. May 16, I catheterized him and his urine is now clear. He has no spasm or pain excepting very rarely.

An interesting part of the case is an apparatus which he has invented, simply a rubber band, more or less like a suspender, extending over the cup which he wears. At night he wears a tin cup, one that anybody can make, and it keeps him dry.

EDITORIALS

THE DIFFICULTIES AND PITFALLS OF TRANSPLANTA-TION OF THE URETERS INTO THE LARGE BOWEL

PROBABLY no more important nor bewildering problem has ever engaged the attention of clinical and experimental surgeons than that of transplanting the ureters into the large bowel. In no other place in the human body does a single principle and the technical procedure necessary to make the principle effective, control such a large field of surgery. For, upon this single procedure, all surgery contemplating the elimination of the bladder as a reservoir for urine depends.

As one reads the literature and records of the attempts made to solve this problem, the most surprising thing encountered is that while the statement to the effect that the ureter opens into the bladder "by a constricted orifice after having passed obliquely for nearly an inch between its muscular and mucous coats" has been in Gray's anatomy for more than thirty years, its full significance was not generally appreciated by experimenters. The knowledge that the ureter ran beneath the loose mucosa for nearly an inch before entering the bladder apparently made little impression for the reason that the problem involved had not been isolated and defined. The problem itself was discovered by accident in a set of experiments in which it was necessary to transplant the bile duct into the intestine below its normal site. Two weeks later, it was invariably found that the duct which had been transplanted directly into the intestine was enormously dilated. This was observed in every case. Obviously a fundamental principle was involved. By tracing bile ducts along their courses into the intestines of dogs, it was found that the duct always ran beneath the loose mucous membrane for a distance before entering the lumen of the bowel. Ducts surgically placed in this submucous position were found not dilated two weeks

after transplantation. The problem had been isolated and its solution had been found. The abstract problem was the delivery of fluids from a viscus of low pressure to one of higher pressure. The solution was found in the production of valve action. The immediate problem at hand was the delivery of the fluid of a secreting organ in the ducts of which the pressure must be low and regular, into a second hollow viscus in which the pressure is high and irregular. The solution was the production of a valve from the non-motile mucous membrane of the second viscus.

Considered broadly, it would seem that the valve is the only mechanism by which fluids and gases, at a given temperature, may be transmitted from a chamber of low pressure to one of higher pressure. Working upon this principle, it was possible to present five undilated ureters and undamaged kidneys of dogs operated upon 60 to 167 days prior to the removal of the specimens, to the Surgical Section of the American Medical Association at St. Louis in June, 1910. Dr. Charles H. Mayo, who was Chairman of the Section at that time, soon applied the principle and technique to the human being. Since that time he has operated upon nearly a hundred patients. His results, taken with those of Lower and operators of less experience, have furnished indisputable proof that ureters thus transplanted safely deliver the urine into the large bowel with very little danger of infection of the kidney as a late result. But the fact that even in these most skilled and experienced hands the immediate mortality from infection was considerable while in less skilled hands it was almost prohibitive, caused many urologists to condemn the procedure as unjustifiable. Even in the hands of these most skilled operators, the fact that only one ureter could be transplanted at a time, thus requiring two or three major operations in removing the bladder, made the operation impractical for most conditions other than exstrophy of the bladder.

The development of the bilateral tube technique described in the November, 1928 *Snrgery, Gynecology and Obstetrics* has placed the operation on an entirely different plane and makes it available for any condition in which it is necessary to dispense with the bladder as a urinary reservoir. For it must be conceded that the successful operation upon thirteen consecutive patients by the same operator without operative death or demonstrable injury to the kidneys, aside from a single fistula from one ureter, entirely removes the element of chance as an important factor. Yet it is easy to foresee many difficulties in the way of establishing this operation as a generally adopted procedure.

One of the greatest difficulties in the way is the tendency of most surgeons to modify a new operative procedure so as to harmonize it with their particular principles. Second, it is going to be difficult to convince many surgeons of the importance of the quarantine which in reality is the means of making the operation extra-peritoneal in effect. There is no gainsaying the fact that this is not a simple operation. It is doubtful if there is any abdominal surgery in which a meticulously perfect technique is more important and in which there are so many details to be looked after. A long and arduous experience, both experimental and clinical, forces the conclusion that there is no important detail described in this article which may be safely omitted. I believe that the quarantine will prove to be an absolute essential if one is to have uniformly good success.

The greatest obstacle of all, however, to the universal adoption of this operation, is that it is essentially a highly technical *intestinal* operation. It is primarily not a urological operation. The great majority of the cases are diagnosed by urologists, many of whom have had very little experience in intestinal surgery and who are therefore likely to meet with frequent disaster.

How are these inconsistencies to be

reconciled? A few urologists are also skilled intestinal surgeons. No doubt, still other enterprizing urologists will by cadaver practice, experimental surgery on animals and a large clinical experience, master this particular feature of intestinal surgery but it is more than likely that the majority of urologists will not. What will this latter group do with their cases? Will they cooperate with the general surgeon who is skilled in intestinal surgery or with urologists who have mastered this technique, or will they, basing their opinions on unfortunate personal experiences, condemn the operation as unjustifiable?

<div align="right">R. C. COFFEY.</div>

ELECTROSURGERY

THE first of a series of articles on Electrosurgery was inaugerated in the February number of THE AMERICAN JOURNAL OF SURGERY. We feel the profession has much to learn concerning this new spoke in the surgical wheel. It is perhaps a more or less general feeling that this field of surgery should be looked upon with suspicion. That this is unfair and without foundation goes without saying. Perhaps this unfavorable idea gained ground because, as is true of all new ideas, it has been adopted and pushed to ridiculous limits and wantonly abused by cliques of pseudoscientific charlatans hiding their collosal ignorance behind the degree of Doctor of Medicine. However, due to patience and persistent hard work many sincere workers have seen a legitimate field for electrosurgery. It is our purpose to have these men, whose reputations are beyond discussion, use our pages to carry their messages.

Grant Ward of Baltimore contributed the first article of this series. This month William L. Clark of Philadelphia leads off the issue with an essay of worth. In April, Howard Kelly continues with a unique article.

Feeling it would not be fair to our readers to assume the task of soliciting and editing these articles we looked about for some one of recognized scientific surgical reputation to guide us. Our quest ended in the happy selection of Dr. Grant Ward, whose large experience and excellent judgment particularly fit him for this task.

Dr. Ward is responsible for the articles on electrosurgery that have appeared and will appear during 1929. He has been given a free hand. All articles on this subject are passed and edited by Dr. Ward and therefore have the mark of authority and scientific worth.

BRITISH LETTER

SIR D'Arcy Power, K.B.E., F.R.C.S., recently gave a short but fascinating address on the revival of interest in surgical literature in England during the first half of the sixteenth century he said:

The Wars of the Roses so troubled England during the fifteenth century that surgery became little more than a handicraft and there was no surgical literature. The process of reconstruction occupied the first half of the sixteenth century and began with an attempt to unite the Fellowship of Surgeons with the Company of Barbers. The former body impoverished and small in numbers represented the consulting surgeons of today, men who had served their apprenticeship in war and found their occupation gone when peace came, the latter numerous and rich, were the general practitioners of the day, and had obtained a Charter as a Livery Company of the City of London. They performed their duties well, but were commercially minded and had no wish to ally themselves with impoverished surgeons who were, perhaps, more highly skilled in their science and had certainly seen more of the world: the very wideness of their outlook might make them inconvenient partners for they would be sure to advocate radical changes in a business which was doing very well on the old lines.

In spite of the flagrantly opposed interest of these two sections of the community professing surgery they were united into one Body Corporate in the year 1540, thanks to the good offices of such leaders as Thomas Vicary, Richard Ferris, Sir John Aylef and James Monford. It was after the grant of this Charter to the

Barber Surgeons of London that Surgery in England as a profession began once more to progress after a long period of somnolence. The cry of the Surgical Reformers was in part the basic principle of their craft published in various writings more or less copied from old masters with additions and comments, the best known of the period being those of Vicary, Hall, and Read. Thomas Vicary was the first Master of the United Company, Sergeant Chyrurgeon to Henry VIII and attached to St. Bartholomew's Hospital. The first edition of Vicary's book is a duodecimo published by Henry Bamforde in 1577. It was called the Englishman's Treasure with the true Anatomie of Man's Body" and was issued posthumously, for Vicary died in 1561. There was most likely, however, an earlier edition published about 1548. The work is so alluring in its sincerity that there need be no excuse for quoting it in part. In the first chapter he declares:

Three poyntes very expdient for al men to knowe, that intend to vse or exercise the mysetrie or Art of Chirurgerie. The first is, to knowe what thing Chirurgerie is; The second is how that a Chirurgion should be chosen; And the thirde is with what properties a Surgion should be indued.

Vicary was evidently well aware that the general education of his professional brethren was defective in many ways; hence he continues:

He ought to be learned and that he knowe his prineiples, not onely in Chirurgerie but also in Phisicke, that he may the better defende his Surgery; And also he ought to be seene in natural Philosophie, and in Grammer, that he speake congruitie in Logike, that teacheth him to proue his proportions with good reason. In Rethorike that teacheth him to speak seemely and eloquently: also in Theorike, that teacheth him to know things naturall, and not naturall, and thinges agaynst Nature. Also he must know the Anatomie, for al Authors write against those Surgions that worke in mans body not knowing the Anatomie, for they be likened to a blind man that cutteth in a vine tree, for he taketh more or lesse than he

ought to doo. And here note wel the saying of Galen, the Prince of Philosophers in his Estoris.

That it is as possible for a Surgion (not knowing the Anatomie) to work in man's body without error, as it is for a blind man to carue an image & make it perfyt. The ijd, I said, he must be expert: for Rasus sayth he oughte to knowe and to see other men work and after to haue vse and exercise. The thirde, that he be ingenious or witty: for al things belonging to chirurgerie may not be written nor with letters set foorth. The fourth (I sayde), that he must be wel manered, and that he haue al these good conditions here folowing . . .

These truly are precepts for all times, namely:

That a Chirurgeon must take heed he deceiue no man, with his vayne promises, nor to make of a smal matter a great, because he woulde be accounted the more famous . . . . Likewise, they shal geue no counsayle except they be asked, and then say their aduised by good deliberation, and that they be wel aduised afore they speake, chefly in the presence of wise men. Likewise they must be as priuie and as secrete as any Confessour of al thingis that they shal eyther heare or see in the house of their pacient . . . . And see they heuer prayse them selues for that redoundeth more to their shame and discredite than to their fame and worship: For a cunning and skilful Chirurgion neede neuer vaunt of his dooings, for his works wyll euer get credits ynough. Likewise that they despise no other Chirurgion without a great cause: for it is meete that one Chirurgion should loue another, as Christe loueth vs al. And in thus dooing they shal increase both in vertue & cunning to the honour of god, and wordly fame to whome he bring vs al. Amen.

One can gather from these few written expressions of Vicary's innermost thoughts how ardently he desired to promote the very highest motives in the younger members following the Craft of Surgery, and his anxiety that they should be led along that path which could alone bring about true fellowship in a noble profession. He is rightly esteemed by his successors as one of nature's gentlemen, gifted with the highest motives and kindliest feelings towards his fellow men.

Power refers at some length to John Hall's "Treatise on Anatomy" which was published in 1565, and describes it as an original work, not a compilation but a simple statement of anatomy as Hall knew it. It was written for the use of apprentices and members of the recently formed United Company of Barbers and Surgeons who were obliged to attend lectures by Dr. Cains and Dr. William Cunningham (1563–1569). Written as it was for those unskilled in the Latin tongue it indicates the information given in the lectures of the period and from it we can gather the type of examination which every apprentice had to pass before he obtained his license to practice "in London and seven miles round." A series of possible questions are constructed by the lecturer from the book for an oral examination (*coram publico*) as was then the custom, which are of more than passing interest to the students of medical history:

1. From what are the words Chirurgion and Cancer derived? Give the Greek and Latin equivalents for each.

2. Mention the complexions of the body. How would you know whether a man was of a sanguine or saturnine complexion?

3. How many bones are there in the human body?

4. What are the uses of the liver? Where does it lie in the body?

5. Define an imposthume? How can it be cured?

6. What does a surgeon mean when he speaks of an algebra? How should it be treated when it occurs in the upper arm?

7. Mention in order the structures which would be divided to expose the great ventricle of the brain, beginning from the skin.

8. Who were Galen, Avicenna, Lanfrancus, Guido Cauliacus, Johannes Vigensis, Andreas Vesalius, Thomas Genuisos and Carolus Stephanus. What discoveries or methods of treatment are connected with these names? N.B. Questions 7 and 8 need only be answered by those who wish to obtain the Company's great diploma. The description of the book ends with "A conclusion" written in pleasing Elizabethan style at the end of the second part:

Lo thus have I ended this second treatise, although grossly and unlearnedly; trusting notwithstanding that it will be gently borne withal. Truly my masters and brethern these are but ears of corns that I gleaned in times past after the bindings of the plentiful sheaves of others, trusting to God that hereafter (though not yet) I shall be able to bind sheaves of mine own and scatter some ears for such as must glean and gather their handfuls of other mens leavings. Neither wish I that we should any longer live than we should show ourselves profitable one to another. In the which as we may learn in holy writ and as the divines continually blow in our ears, we shall be known to be servants of our Lord and Saviour Jesus Christ who taught his disciples to love one another. Saying by this ye shall be known to be my disciples in that ye love one another. The which love God grant us all. Amen.

ULCERS

During the past year much has been written in the medical press and propounded at medical meetings on the surgical treatment of gastric and duodenal ulcers in this country. But so great is the divergence of the views and methods of well-known surgeons that a short résumé of a few individual surgeons' preferences may be of some assistance in establishing a line of action in certain cases.

We cannot hope here to enter into the various theories of the cause of ulcer over which there is still a considerable clash of opinion, save to mention the responsibility of sepsis and bacterial necrosis of the alimentary mucosa, and a peculiar ulcer diathesis (Hurst).

There is still an unfortunate confusion of terms which adds to the difficulties in correlating the writings of various surgeons. For instance the term peptic ulcer is loosely used to indicate an ulcer within touch of the gastric juice which may be therefore gastric, duodenal or jejunal. Again other terms such as "gastroduo-

denal" ulcer and "juxta pyloric ulcer" "prepyloric" and "postpyloric ulcers" have been introduced.

Moynihan lays great stress upon the pyloric vein as a boundary mark between the duodenal and gastric ulcer, and maintains that the basis of treatment depends upon the location of ulcer. Dr. Izod Bennett declares there is practically no difference between a duodenal and a gastric ulcer close to the pylorus and the relation of the pyloric vein to the pylorus is not constant and therefore may be misleading. This need not be considered a difference of vital importance for Moynihan further states in an analysis of over 2000 cases, less than 3 per cent of chronic gastric ulcers occurred at the pylorus or within 1½ inches of it, so that gastric ulcer close to the pylorus is very unusual. Therefore although there may be differences of opinion as to the exact geographical location of the ulcer the resemblance in the symptomatology of these ulcers in the vicinity of the pylorus are such that with regard to surgical treatment they frequently demand the adoption of identical methods.

The question of treatment of duodenal ulcer has been particularly prominent in the medical papers and amongst others Drs. Hurst, McLean, Spriggs and Izod Bennett have expressed their opinions very forcibly that in the majority of uncomplicated cases operation is unnecessary.

Dr. A. F. Hurst in a recent address at the Cardiff meeting of the British Medical Association said:

Surgery has taught us that duodenal ulcer is a common disease with characteristic symptoms instead of an undiagnosable rarity. It has taught us how frequently gastric symptoms are the reflex results of disease in the gall bladder and appendix. Finally and most important it has shown us how often it fails to cure the disease it has taught us to recognize; and how often it gives rise to new and artificial diseases formerly unknown. It has thus stimulated us so to improve our methods of medical treatment that we may look forward to the day when all unsuccessful gastro-jejunostomies have been undone, and the only gastric operation the surgeon is called upon to perform is gastrectomy for early carcinoma.

This is undoubtedly a very incisive summing-up on the situation by a physician and a challenge to the surgeon either to establish present-day operative procedures on a sounder basis or give way in favour of the physician. The general consensus of opinion at present is that medical treatment including rest, diet, alkalis, and the elimination of any definite foci of epsis should be tried first.

This treatment, too, often fails even after a second and third trial, because to be effective the time required cannot be given. Usually the unfortunate patient cannot afford the time and the necessary expense and even then the rigorous dietary is liable to be broken, for to many it is extremely disagreeable. Then again should the ulcer heal with the treatment there is the possibility of deformity resulting such as stenosis of the pylorus which will require later surgical treatment.

It is therefore evident that one must take into consideration the type of patient and study that patient from every angle (mental outlook, occupation, surroundings, obligations, extent of the individual's purse and so on) and not suggest a medical cure when it is practically unattainable for obvious reasons. This being so we can consider the types of operation most likely to give a cure quickly and with the least possible risk to a person suffering with a chronic pyloric or duodenal ulcer. The surgical measures adopted in this country can be discussed under three headings:

1. *Simple Gastroenterostomy.* This operation gives very good results, the bad results as a rule follow errors of technique. This method has the support of Sherren and Patterson, and is still adopted by many surgeons. There are certain drawbacks, the ulcer may bleed, may perforate, may not be cured.

2. *Gastroenterostomy Combined with Enfolding of the Ulcer.* Walton imbeds the ulcer with a running mattress suture, and if the ulcer is on the posterior wall he takes up so much of the anterior wall in his suture that the lumen is completely occluded. Moynihan in the case of posterior duodenal ulcers opens the duodenum cauterises the ulcer and temporarily closes the duodenum, with an encircling suture. He removes the appendix and investigates the condition of the gall bladder, spleen and liver. The patients in his clinic are most carefully prepared and a post-operative treatment exercised for months including special instructions as to diet and the use of drugs. Moynihan has now had a series of 500 cases of duodenal ulcer without any mortality.

3. *Pylorectomy or Partial Duodenectomy (Pannett).* This method has few advocates. Pannett is the chief exponent of the operation and believes it to be the only way of ensuring freedom from such complications as gastrojejunal ulcer, haemorrhage, recurrence of ulcer, perforation and cancer. He admits the difficulties and dangers of the operation he has devised but thinks the technique can be so improved that these will be rendered neglible. Quoting Finsterer's results (1.4 per cent mortality in 71 cases) in his own series he has had 2 deaths in 29 patients, one from cardiac failure, the other from broncho-pneumonia.

These are the usual types of operation for chronic ulcers in the neighbourhood of the pylorus practised in Great Britain. Amongst surgeons generally it is felt that after a fair trial of medical treatment surgical measures should be adopted as the most effective method of obtaining a cure. The risk is small and in a well-planned operation the results are excellent. The failures after operation are due most frequently to the development of an ulcer at the site of the anastomosis, but even this complication is comparatively rare. The fault must lie in some defect in the technique; maybe a badly planned anastomosis, defective union, too rough sewing, too vigorous clamping (in fact union without the aid of clamps is better and safer), too large or too small an opening, contraction or kinking at the mesocolic aperture, gross anatomical mistakes, operation where there is no observable lesion, want of proper attachment of the opening in the mesocolon. These by no means end the list of possible errors but enough has been said to account for some of the failures which come back into the hands of the physicians.

John H. Watson, m.d., f.r.c.s.
Burnley, England.

NOTICE OF COMPETITION

Istituto Ortopedico Rizzoli in Bologna

THE competition for the prize Umberto I. has been opened. This prize of 3.500 lire will be assigned, according to the decision of the Provincial Council of Bologna, for "the best orthopaedic work or invention." Italian and foreign doctors may take part in this competition. The arrangement of the competition and the assignation of the prize is fixed by the regulations which will be sent to whoever asks for them. Application for the competition should be made to the President of the Rizzoli Institute in Bologna. The competition will close December 31, 1929.

The Commissaire of the Prefect
Avv. Umberto Turchi

Bologna, January 1st, 1929.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

MEDICINE, CHARLATANRY AND LITERATURE
A PSYCHOLOGICAL STUDY OF QUACKERY

HEINRICH F. WOLF, M.D.

NEW YORK

THE discovery of the basic foundation for the causes of evil conditions alone enable us to build up a method for their improvement. The question, however, as it relates to our subject, is not correctly answered by words like "charlatanry," "quackery" or "fakery." These are only words, which do not lead us to any solution. Those of us who agree with physicians, do not need more enlightening definitions than these, but those who are indifferent or antagonistic to the medical fraternity as a whole will think that we are envious and are not treating them fairly. We must, therefore, try to get at the foundation, or the psychology, of the subject and describe conditions as they exist and the ideas which led to these conditions.

During the last two decades we have heard much about the fight of the medical profession against the various forms of so-called "quackery," politely called "illegal practices,"—the chiropractors, naturopaths, neuropaths, Christian scientists, bone-setters, and so on. We have read about the efforts of the medical men who try to stem the flood of charlatanry, through organization and legislation, from rushing into the field of medical science and carrying away a large number of "victims" whom they call patients. But, in spite of the combined strength of all the efforts of the medical men, one aspiring group after another has wriggled through the loopholes left by the law. And having "wriggled through," they swell and swell with all the pride of the profession they try to imitate. They would die through their self inflation and its resultant ridicule; but the medical profession could not let them die because the events in the interim are too closely associated with life and death.

Physicians do not seem to learn from medical history that invasions of their field cannot be stopped by force; and besides, the medical profession, in many instances, has used very bad judgment to stop it. For a case in point take the hostility which the medical profession showed against the farmer Priessnitz, one of the founders of modern hydrotherapy. This hostility, however, did not prevent his becoming a great healer and being consulted by the highest and lowest the world over. Later, when Winternitz, the father of scientific hydrotherapy took up this work, it was many years before he was able to force the medical profession to acknowledge the value of physical therapeutics. It will

be remembered that only a few years ago these methods were considered as but a poor form of quackery.

Lately, George Bernard Shaw has taken up the cudgels for the bone-setter, Sir John Barker. He viciously attacks the General Medical Council, representing the medical profession, for not knowing this unquestionably able man. He does not realize that the fault of the General Medical Council does not lie in the fact that they do not acknowledge a bone-setter, but that they do not acknowledge Sir John Barker; or, if you want to express it in medical language, they treat a type instead of treating an individual.

I regret that I do not know Sir John Barker, but I am quite certain that he, like all physicians, must have his failures, only people do not hold them against him. If he fails, people shrug their shoulders and say: "He is only a bone-setter after all." We must not forget that failures give us better judgment of a method than successes. The results which these bone-setters have is probably due to a large extent, to the fact that they resort to treatments so brutal, a physician would not dare to use them. The responsibility of a physician is greater in scope. In this connection I am reminded of an assistant of Winternitz who used truly heroic methods on his patients, real horse cures, which sometimes gave him unexpected results but which, in other cases, did great harm. There are unquestionably, however, laymen who have a natural therapeutic instinct and at times may find a way to a cure which the physician following a routine will not obtain.

The legitimate and justifiable, but unwisely conducted fight of the medical profession against the quacks has produced a bond of mutual interest among the various sorts of charlatans. There is no question that we could get rid of most of them if only we could make the experiment of turning them loose on the poor public. But, of course, this would not be feasible. It would be just as costly as the methods of war to end war.

Let us see whether we could go to the source and try to stop the flood there. The source of quackery and the mainstay of the charlatan is ignorance, not ignorance in the general sense of the term, but lack of specialized knowledge; in the case of the physicians, the ignorance of the educated public to medical matters. My confrères will ask in refutation of this: "Do we not try to remedy this ignorance by enlightenment of the public through lectures?" This is very true but, unfortunately, the best these lectures can do is to disseminate only half-knowledge and half-knowledge is often worse than none at all. Without a thorough knowledge of physiology, anatomy and pathology, an understanding of the phenomena of human life is impossible. Do we not find, even among medical men, the most abstruse, absurd ideas about pathological conditions in branches with which they are not familiar?

I heard someone, this time it was not William J. Bryan, speak of intussusception of the convolutions of the brain. This is laughable, but when one looks at the exposed brain and the exposed intestines, one realizes that there is so striking a resemblance between the external appearances that this expression does not appear as stupid and ridiculous to the lay mind as members of the medical profession know it to be.

Let us take up popular ideas about gases; about colds; about driving a disease from one part of the body to another; these surely cannot become eradicated where the true conception of facts does not exist. Contradictions cannot make themselves apparent where there is no standard of truth.

To the mind practically devoid of all essential premises on which to base a correct conclusion, nothing appears illogical or ridiculous, monstrous or impossible. It is admitted that many an expert has shown himself to be an expert only in conceit because he considered his own limitations as the limitations of the universe. Scarcely one hundred years ago experts declared that human beings could

not breathe while being carried in a train which would hurl them through space at the terrific speed of thirty miles an hour!

To a mind untrained in a particular field and its branches, the most absurd nonsense, the most obvious misstatements will sound as true as Holy Writ. This will explain why men most prominent in their particular field—law, economics, industry or literature—belong to the clientèle of quacks and charlatans. Archbishops and justices of the highest courts, professors of universities and princes of finance, artists of highest repute and authors of world renown have flocked to the charlatans and sworn to their supernatural powers, their knowledge, and their theories.

I do not speak here of miracles and the millions of white people who believe in them. The medicine-man of the savages, of the heathen, is of course a poor swindler. The Hindu who washes off his ills in the sacred waters of the Ganges is ridiculous, though he, at least, gets a bath. But the pilgrims to Lourdes are blessed by the Lord.

What interesting analogies! The old Greek who bowed his head before the wonderful statues of his great masters was a heathen, but those who believe that a certain image of a particular saint has a special power and works miracles, are inspired by God. The poor Chinaman who rattles his prayer-wheel is an idiot, but the clicking of the rosary beads proves the wisdom of the peasant woman.

The object of this article is to show that ignorance in medical matters is not attributed to the intellectuals merely as a matter of hearsay. Laughable misconceptions reveal themselves in the works of modern writers.

Szienkievich, in one of his short novels, lets a boy die from meningitis because he had done too much studying, but I do not want to pass judgment on him. Fifty years ago many medical men may have harbored such an idea. The infectious nature of the disease was not known then. Besides, one could infer that the boy undermined his

health by intensive study and acquired a tubercular meningitis.

A pupil of Schopenhauer tried to illustrate this philosopher's ideas about the brutal will in nature, and even committed suicide, carrying his master's thesis to the final conclusion. The author, in his story, speaks of a tenor who had been working and waiting for a chance to sing in public. He was a wonderful artist but when his first chance came he developed pneumonia. Was it astonishing that he did not sing quite as well, having pneumonia, as he would have sung without it? Can the public be blamed which laughed him off the stage? The poor artist died of pneumonia. Had the author possessed an inkling of the nature of pneumonia, or had he ever had pneumonia, I am sure he would have made his hero the victim of walking typhoid.

But let us go on to the present day. Everyone will admit that Arnold Bennett is a talented author. Everyone will likewise agree that he is a poor diagnostician. In his book "Hilda Lessways," he says:

Sarah Gailey was lulling herself in a rocking chair when Hilda entered. She neither regarded Hilda nor intermitted her see-saw. Her features were drawn into a preoccupied expression of martyrdom and in fact she constantly suffered physical torture. She had three genuine complaints: rheumatism, sciatica and neuritis. They were all painful.

The latest and worst was the neuritis which had attacked her in her wrists, producing swollen joints that had to be fomented with hot water. Sarah Gailey's life had indeed latterly developed into a continual fomentation and a continual rocking. She was so taken up with the elemental business of fomenting and of keeping warm that she had no energy left for other remedial treatments such as distraction in the open air.

I doubt if any of you will take Bennett as a consulting physician.

I do not want to ask your opinion on Henry Barbusse. I like radicals and I like Barbusse's writing, but as a pathologist he is a failure. Note what he says in

"Inferno" about a consultation of two physicians:

The man with the gray beard murmured, "I detect sarcoma." He puts his finger on his neck. "Right here." The other man nodded, (his head seemed to be nodding continually), and muttered: "Yes, there is no possibility of operating." "Of course not," said the old specialist, his eyes shining with a kind of sinister irony. "There is only one thing that could remove it, the guillotine. Besides, the malignant condition has spread. There is pressure upon the sub-maxillary and sub-clavicular ganglia, and probably the maxillary ganglia also. His respiration, circulation and digestion will soon be obstructed and strangulation will be rapid." Then the house physician talks to the young woman, probably his wife. "Sarcoma forms like the human embryo" said the younger doctor. "Yes, like the human embryo," the other assented and entered into a long elaboration of his idea.

"The germ acts on the cell, as Lanceraux has pointed out, in the same way as the spermatazoa. It is a micro-organism which penetrates the tissue and selects and impregnates it, sets it vibrating, gives it another life. But the exciting agent of this intra-cellular activity, instead of being the normal germ of life, is a parasite. The cancerous tissues never achieve full development. It keeps on without ever reaching a limit. Yes, cancer in the strictest sense of the word is infinite in our organism."

This may be a prophecy, but the discrepancies in all of these statements as applied to modern science might be due to the fact that the man who narrates the story sees and listens through a crevice in the wall. Thus he may have misunderstood what the physicians said.

"Man in War" by Andreas Latzko made quite a stir during the war. It is said to be the strongest argument against war. In a chapter of the book called "Baptism of fire," Latzko says:

On slowly recovering his consciousness he found himself buried under a huge mound of earth, with only his head and his left arm free. He had no feeling in his other limbs, he couldn't find his legs. Nothing was there that he could move.

His left hand struggled toward his head and when he succeeded at last in pushing it under his neck, he felt with a shudder that his skull offered no resistance and his hand slid into a warm soft mush. With a superhuman effort he propped his head up on his left hand, high enough to have a view of a few paces along the trench. The captain had to see. He pulled his head farther out from under the mound . . . etc.

There is no fault to find with his principles, but why didn't the author ask a military surgeon for advice?

Could Latzko not have found out by a simple inquiry that when a man's neck is broken he not only cannot hold up his head but his arms are paralyzed, too? Besides, according to the description, the brain was destroyed. The story is gruesome but it would have been just as terrible if he had left the commander lying on the ground suffering from some other wound.

Michael Arlen has written a book called "The Green Hat." It shows esprit, it is full of humor, the language is beautiful. I liked it so much that I actually bought it, though it may show my poor taste. But medical science, as promulgated in it, is truly deplorable. I am ready to forgive Arlen that he lets the first child of the heroine die because it wanted to get out feet first. Arlen does not mean to talk of a breach presentation; he seems really to believe that some children walk out at confinement:

Well, and then—Oh, and then they killed Hector just in time, and when Hector-not-so-proud came along he thought, the poor sweet, that the proper way for a gentleman to arrive in the world was toes first to slow music, and so away he had to go.

Wealthy women, particularly when they are married, have a physician attending their accouchement and we know that at a version the child is delivered feet first. This is not a particularly dangerous form of delivery for the child. But this child had to die for the sake of the plot!

It happens sometimes, even with the best medical attention, that women become

infected at childbirth and get septic poisoning.

It is, however, new to me that a woman thus critically ill, with a temperature of 106°F., cannot get better because "she does not want to live," but does get better through no other remedy than that of seeing her lover. He gives her a new purpose, a new hope for life.

We physicians have seen many a case of septic poisoning where the whole family, the husband, and all the lovers in the world could not help, though the patient wanted to live. "Today we have thought that she will not die," said Sister Virginie, "for last night we gave her a picure du coeur." "Picure du coeur" sounds so well in a book, but would not be crowned with success in real life in a case of septic poisoning. It is not to be wondered at that the doctor who found that ingenious remedy cured the patient so quickly. She was not allowed to move about for weeks, but one month after leaving the hospital: "she drove a car like mad and at the end of the evening saved the life of her friend and adversary, the wife of the lover through whose mere appearance she was cured. She saved her from drowning by jumping into the water after her, in the pitch dark night." It is remarkable that such things do not happen in real life but the author could have waited a few months longer.

All this I can forgive Arlen, but what would a medical man say of the discourse of the physician who treated her? The author does not mention whether it was the same man who infected her at confinement:

I suppose this is the crisis, Masters? . . . Crisis! The way you people talk of crisis this and crisis that! Hear a word once and stick to it through life. "When does the crisis pass?" There is no "crisis" in most of these infernal things—malaria, pneumonia, a few others—yes, crisis, you know where you are. But in these things the patient just continues ill, two, three, four weeks, might live, might not. Lysis, not crisis.

Crisis in malaria! Lysis in septycemia!

Poor Aesculapius! And then people say misdeeds are punished. Surely not in this world!

As poetic license we may take the statement of the heroine, who, six months after her second confinement says: "I am proud of my breasts, because they are so beautiful. Life is generally so rude to a woman's breasts but it has only kissed mine." This, however, is a very common poetic license and he who takes the trouble to read Casanova's stories as well as those of others will be astonished to hear that so many of the numerous sweethearts were equally blessed by nature.

One has to be a great deal more careful with George Bernard Shaw. In his preface to "The Doctor's Dilemma" he viciously attacks the medical profession at large, while he has very kind words for some of his medical friends. There is no question that the medical profession as a body is extremely reactionary, but this phenomenon finds its analogy in mass psychology. Whenever human beings act en masse and thus lose the sense of individual responsibility, the aggregation almost invariably shows the worst traits of the individuals combined.

The great psychologist Shaw should realize that opposition to an intruder is a human phenomenon, in fact a general phenomenon of living matter. Observe what osteopaths did and do to the one who tries to use their methods without official sanction of their governing body.

The question is whether one should open the door to everybody who claims that he can cure people, thus endangering them, or try to protect the patients and harm a few for the sake of the many. I hope that Shaw will be able to agree on one thing; that there must be some kind of protection against ruthless exploitation of the public. Why does he not offer a solution of the problem? How it could be arranged to give to the layman the very difficult training which the modern physician needs before he is allowed to practice; and at the same time give an equal right to men who

have not had this difficult training and so are ignorant, as far as medical science is concerned but who, by instinct, by inborn genius, by special fitness, have acquired the ability to be helpful in a very limited field of human pathology. There is one way, but it is so narrow that human beings who easily swell from conceit cannot travel it. This way would be to disregard rules and to adjust oneself to special situations, to be guided but not determined in one's action by law and precedence.

A friend of mine used to write short articles for country newspapers with the idea of spreading a knowledge of grammar among readers of the paper. Once, for illustration, he quoted at length a very short story of a living author. As soon as the author heard of it he insisted on getting his "honorarium," though he was told that my friend did not get money for his articles, that they were written for purely didactic purposes. Probably Shaw would not do this and it is for this reason he believes that he has the right to object to the medical profession, which prosecutes trespassers, though the trespasser may be a better man than they are.

After all, medical men are human beings first, and must be judged by that standard. There is no question that physicians often act inconsistently. There are men who would willingly burn all osteopaths at the stake, yet will refer a certain patient to an osteopath for treatment. The trouble with present-day medicine is that its scope has so widened that it is hardly possible for an individual to master his own specialty. It cannot, therefore, be wondered at that medical men sometimes give wrong advice when they cannot possibly know all the details of the branch of medicine practiced by a colleague. We can understand that he may condemn methods because he knows nothing about them. Only in this way is it intelligible that the medical profession as a body condemned without examination or justification, Swedish gymnastics, the water treatment and treatments with various electrical modalities.

A great sage once said: "I know that I don't know anything," and for this one remark he deserves to be called a sage, as only the one who knows what he is lacking in knowledge divines how much there is to be known.

In medicine, probably more than in any other science, we appreciate that there are vast unexplored regions. The writer studied bacteriology as a student and as a post-graduate and has followed, to some extent, the progress of this branch of medicine. But not in his wildest dreams would he permit himself to judge authoritatively the results of those men who make bacteriology their special study. Shaw however read, according to his confession, one book on bacteriology which, taking into consideration his preliminary education, he could not understand and yet he passes judgment on the validity of various theories. I wonder what Shaw would say if I were to pass judgment on the literary value of his work on the strength that I understand the English language. But he himself, medical expert only by the grace of George Bernard Shaw and forbearance of the Lord, does not hesitate to teach the public what attitude they may take toward the medical profession and medical science. I read in *The New York Times* of February 12, 1927, that he opened an osteopathic clinic for the poor in London. In a fit of modesty, unusual for him, he said that he was not an osteopath and went on to say: "I am getting into a state of mind where I dare not wander into Westminster Abbey or St. Paul's Cathedral because I know the next day the press would say I founded the Church of England." We may accept his admission that he is not the founder of the Church of England, not an osteopath, not a physician; but he is a man of letters, a man with a logical mind. Does it then not occur to him that by founding a clinic of osteopathy he is committing the same blunder as a physician who is merely an allopath or a homeopath or a hydropath or a what not? Is'nt this onesided too? Is it not obvious

that a physician should be a physician and adjust his methods to the patient instead of the patient to his methods?

Shaw seems to have great faith in the osteopath and the bone-setter. There is no question that some methods of both are valuable. Their value, however, is determined by their physiological action. It is silly to say osteopathy or hydrotherapy or medicines are effective. They are effective only in certain cases because they produce reactions in the body which are desirable in those particular bodies. This is disregarded completely by medical men who indiscriminately condemn a method instead of accepting what is good in that method and using it.

In certain Catholic countries where priests engage in political controversies, we find many individuals of opposing political faith confusing the issue and attacking religion instead of its representatives. The stand that Shaw takes against the medical profession, which is certainly justified to some extent, make him attack medical science, for which attack he is not in the least qualified.

Anyone, being impartial and unbiased and knowing something about medicine, would be highly amused at articles by Shaw in the London Nation, February 3 and 10, 1923. In the fashion of a true medical Don Quixote he argued against inoculation of smallpox from one individual to another, and talked about the dangers of this procedure. As if any sane physician would use anything but cow lymph. He might just as well argue the point of machine guns against bow and arrow. He talked about babies who died after vaccination. He does not realize, evidently, that these deaths were due mostly to inefficient asepsis, simply because he does not believe in asepsis. It has happened that people became severely infected after a manicure and have even died of the infection. I am glad that this is not known to Mr. Shaw. Logically, he would be obliged to go about with dirty fingernails.

It is true that statistics lie; but why call

the fact published by the German army, that smallpox was stamped out after 1874 lies, and swear by those of Almroth Wright? "Wer Recht behalten will und hat nur eine Zunge, behälts gewiss."

The stamping out of the plague in Bosnia and Herzegovina after the Austrian occupation by the use of vaccination should convince the most ignorant or bigoted, particularly in view of the fact that any attempt to improve the general hygiene of the inhabitants would have been hopeless.

I quote the following editorial from *The New York Medical Week*, May 21, 1927:

An Unenviable Distinction. To Americans who are accustomed to regard their nation as one of the most progressive in health matters it will come as a distinct blow to learn that during 1926 more cases of smallpox were reported in the United States than in any other country outside of Asia. The doubtful distinction of such a record is the more to be deplored in that smallpox is definitely a preventable disease. Ten European states were entirely free from it in the period under survey and the combined reports of eighteen others amounted to one thousand cases as compared to thirty-three thousand, seven hundred and fifty-two for the United States alone.

It is notable that the incidence of smallpox follows the same graphic curve as the development of anti-vaccination sentiment. Where inoculation is extensively employed in a community the disease disappears. Let the anti-vaccinationists win a place and within a few years smallpox is seen to be on the rise. Southern California and Northern England are conspicuous examples of this.

Shaw is careful enough not to speak of diphtheria antitoxin and its value. He evidently does not want to know of those things which do not fit his argumentation. He attacks typhoid vaccination and I wonder whether he knows that in the Spanish-American war more soldiers died of typhoid than died of wounds, while in the last war typhoid took proportionally very few victims in all armies.

Does it not occur to the apostles of anti-vaccination that sanitation, which is supposed to have helped to bring about the

decrease in the number of smallpox cases, is of no value in those forms of disease where a specific organism has not, so far, been found and where, on this account, an effective vaccination is impossible. In smallpox we have at least the specific agent, though we cannot identify it.

While we say that people can prove everything they want to by statistics, no sensible person will disclaim altogether their value. Again it must be said that statistics should be weighed carefully, more carefully than Shaw does when he speaks of the success of bone-setters and osteopaths. There are few people who realize that the value of a treatment is characterized more by the absence of failures than by the presence of success. Just as a connoisseur in art proves himself to be one not by the good pieces he has, but by the fact that he has only a few bad ones.

Bacteriology is a very difficult branch of medical science. Few physicians not specially trained would dare to discuss bacteriological problems, but only their practical application. To show how difficult it is to talk logically about such problems unless one knows the details, I may quote one of Shaw's passages from his article of February 10: "As a dead microbe will serve as well as a live one, just as a dead man is as infectious as a live one, it follows that the microbe like the man is the vehicle of and not the prime cause of it." What rubbish! A dead microbe is not infectious but simply poisonous. It is not infectious because it cannot grow; t is poisonous because of the foreign proteids contained in its body. A dead man is infectious not because he is dead, but because he may carry live infecting organisms. And if it is correct that the microbe is not the prime cause of the disease, it is so only because there is never only one prime cause. In fact, there is no cause at all but there are conditions leading to manifestations, which we call disease.

Just lately Shaw took a very decided stand for evolution and against William Jennings Bryan. If I am not mistaken, he speaks in this connection of infantilism; yes, he even speaks of blockheads and does not seem to exclude Bryan from this fraternity. Is it not strange that Shaw, who knows all about infantilism in the theory of evolution, does not know enough about infantilism in medicine?

How are such errors possible in the books of authors of repute? They do not ask for advice because they are not aware of the blind spot in their minds.

I have no reason to belittle these authors whom I really admire for their literary qualities. Such mistakes are amusing to the medical man, and they do not necessarily interfere with the beauty of the writing. The anachronisms found in Shakespeare have not prevented us from regarding him as the greatest dramatist of all times. To me they prove simply how very unsophisticated even the intellectuals are in medical matters. When such things occur nowadays with the best in the land, what then can we expect from the rank and file?

Nothing amuses me more than the attitude of the general public that the possession of a body connotes knowledge of it. With what glibness they talk of the most difficult subjects in the world, difficult even to the trained medical man! They are prone to ridicule a wrong diagnosis because they do not realize the utter impossibility in some instances of making a correct one. They are not aware of the fact that even if it is possible to make a diagnosis and classify a disease, the cure of that disease might be impossible. If a man has a run-down automobile he throws it on the junk-heap, but he thinks a run-down body can be exchanged part for part.

If would be very helpful all around if people would realize that physicians are not endowed with divine power. In fact, I may go so far as to say that the most highly trained and scientifically minded physician is the most human of individuals, as the clear light of knowledge dispels the clouds of pseudo-sanctity in which the medicine-man and the charlatan are mysteriously robed.

Unfortunately, a large part of the public takes note only of the shortcomings of the medical man and recognizes only reluctantly his accomplishments, just as we notice the shoe that pinches us but are unconscious of the one we wear in comfort.

Patients often complain of medical ethics. There cannot be any question that medical ethics are extremely immoral. If it is true that the welfare of the patient ought to be the highest law, then ethics must be revised, as they constitute a flagrant violation of this law. If we look at it historically, we can understand that medical ethics are a necessity. So long as medical science has not become an absolutely exact science, and this it never will be, so long as the scope of this science is widening and an all-around knowledge and thorough experience in all branches is more and more difficult, discrepancies among doctors both in regard to diagnosis and to treatment must arise daily. Without medical ethics some consultations would be disastrous. They are bad enough now but without the restraint of medical ethics the situation in the medical profession would be deplorable and the one who would suffer most by it would be the patient.

But do patients not suffer now? Certainly! Very often they do, but the question is not to cast Satan out by Satan, to abolish medical ethics and make matters worse, but to modify them, modernize them, keep them alive. To keep a law alive does not mean to carry it out to the letter like a petrified statute but to allow it to grow and to change according to conditions. Life means Change.

On the other hand, every now and then one reads of the various efforts medical men make to check charlatanry; and plans are now afoot to establish psychiatric clinics to help young students and medical men to cope with these evils. Fruitless labor! As long as there are incurable diseases, as long as there are conditions which are not understood by medical men or which are not properly treated, as long

as there are conditions which cure themselves and for which credit is given to the one who treats the case last, quacks will flourish. They will flourish because the quacks, on account of their own ignorance, can talk to patients nonsensically enough to be fully understood. Where a definite pathological process exists, patients will suffer, but the degree of suffering depends upon their state of mind. Fear, worry, anticipation of trouble, may interfere with the curative action of the body. It is here that Christian Science methods show their results. Many a patient would get along better if the physician could afford to let the case take its normal course and if the patient would stand for it. Many patients become indignant if one tells them that they will get well without treatment, but that it will take time. Many patients prefer to have medical treatment, others really enjoy having bad health. Others again see in their troubles a method of dominating their surroundings.

Even among physicians it is not generally appreciated that the manifestations are not disease itself, but the reaction to disease-producing agencies. It is generally forgotten that there are no diseases, but only sick people and that we are long past the stage when we looked on disease as a demon who had entered the body and who could be driven out.

To return to our original statement: We can say that charlatanry is not primarily due to the fact that people want to be humbugged, as Edgar James Swift said in *Scribner's Magazine* of October 1925, though we cannot deny that this may be one of the psychological roots; the primary basis is lack of education in medical matters. It sounds strange that an individual who is well trained in medical matters, such as a physician, is often more easily fooled than a layman, because he wants to be. I have seen many colleagues suffering from malignant diseases fooling themselves intentionally into a state of hopefulness. These physicians pretend to themselves only regarding the outcome of

the disease, but they do not go to charlatans for treatment.

Unless education in medical matters becomes a great deal more diffused, a change in the attitude of the public cannot be expected. It is, however, advisable to keep the fact before the eyes of the public that the lack of medical knowledge in an individual is an insufficient guarantee of his superior ability as a healer.

Forcible methods will never succeed because the ignorant public will always side and sympathize with the man whom they consider unjustly oppressed. If they were aware of the incapacity of the charlatan they would not go to him and these poor devils would starve. But if they do believe in them, no legislation on earth, no arguments as to the dishonesty of their practices, will be of any avail.

BOOK REVIEWS

The key-note of A TEXTBOOK OF SURGICAL DIAGNOSIS,[1] as expressed by the author in the preface, is his statement that among surgeons "the opinion has been widely expressed that the weakness of modern surgery lies in diagnosis." With this statement few surgeons will quarrel. His further statement that "there is . . . a growing tendency to lay stress, and perhaps undue stress, upon the value of laboratory and other special methods of investigation." These volumes, edited by Dr. Walton, contain over 1100 pages with almost 600 illustrations. Each chapter is written by a specialist of the first rank and the editor has succeeded well in correlating the various articles so that they make interesting successive reading and almost any surgeon will find this book useful to have at hand when faced with a puzzling problem of diagnosis. Authoritative and concise, well printed and substantially bound, this book is entitled to a place in the library of every surgeon.

The committee on publications of the Mayo Clinic states in the foreword of COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION,[1] the ninetecnth volume of the series, that:

"Papers of interest to the greatest number are presented in full, those in more limited fields of medicine are abridged or abstracted and those in special fields are indexed according to the journal reference. This arrangement was made necessary in order to keep the annual collection within the limits of one volume. It is believed that the arrangement also best serves the reader."

When it is realized that this statement is the necessary preamble to a volume representing the literary out-put for only one year of a private medical institution it is almost the equivalent of writing a new chapter in the history of medicine, not only of America, but of the world.

There are 1330 pages presented, of vitally interesting material, by the active workers in the world's largest surgical clinic. This annual volume is a necessary addition to every medical library worthy of the name.

A concise and thoroughly practical manual of surgical anatomy is here presented in a fourth edition. MANUAL OF SURGICAL ANATOMY[2] is well written, well illustrated and well printed, and may be recommended both to students and young practitioners.

TUMORS ARISING FROM THE BLOOD VESSELS OF THE BRAIN[3] is a most concise, thorough, and authoritative work such as we have come to expect as a matter of course from the pen of the senior author. Surgeons operating on the brain will not fail to add this book to their own library; others will want it in the local libraries for convenient reference.

The book is divided into two parts, first, "The Angiomatous Malformations," and second, "The Hemangioblastomas." Each part is followed by a complete bibliography. The illustrations are beautiful and unusually well reproduced. The typography is splendid, though the copying of the German method of emphasizing by letter spacing and extra leading

[1] A TEXT-BOOK OF SURGICAL DIAGNOSIS. Edited by A. J. Walton, M.S., F.R.C.S., B.SC., M.B. N. Y., Wm. Wood & Co., 1928.

[1] COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION for 1927. Vol. XIX. Edited by M. H. Mellish and H. B. Logie. Phila., W. B. Saunders Co., 1928.
[2] MANUAL OF SURGICAL ANATOMY. Ed. 4. Revised and enlarged. By Charles R. Whittaker, F.R.C.S. (Edin.) F.R.S.E. N. Y., William Wood & Co., 1928.
[3] TUMORS ARISING FROM THE BLOOD VESSELS OF THE BRAIN. By Harvey Cushing and Percival Bailey, Springfield, Ill., Charles G. Thomas, 1928.

distracts from easy reading as well as from the beauty of the page. Authors and publisher have worked harmoniously in the production of a new classic and both are to be congratulated.

The second edition of what may be considered the standard in roentgen therapy has just been issued from the press of Barth with contributions by the leading men of Germany. Lehrbuch der Röntgenkunde[1] shows evidence of the most careful editing and may be considered as a compilation of all that is authoritative and authentic on the subject of roentgen therapy up to the minute of publication.

Worthy of special mention is the chapter by Seitz on "Roentgen therapy and Gynecology." The article on "Neoplasm" by Reader and Groshy is written in just the right tone of conservatism. Throughout the work the enthusiasm of the special pleader has been well checked to accord with modern, conservative, scientific proposals and it is felt by the reviewer that any physician may turn to this book for some time to come, for a concise and authoritative statement of what may and what may not be expected from roentgen-ray therapy in any given condition. This volume is another monument to German *Gruendlichkeit*.

The third volume of Internationale Radiotherapie[2] is before us in a book of 329 text pages, another tribute to the diligence of the Editor. The book is thoroughly up-to-date and has truly an international flavor and will be found invaluable by everyone interested in any way in radium, roentgen or light treatment.

The review of the second edition of Die Chirurgie der Brustorgane[3] published in The American Journal of Surgery in March, 1921 spoke of a future edition which its inherent worth would surely command. This prophecy has been fulfilled and to such an extent that the 916 page volume before us is only volume one, part one of the new edition.

More elaborate and complete than ever this third edition of this classic will maintain its preeminent place as the international standard on surgery of the breast. With Teutonic *Gruendlichkeit* Sauerbruch and his collaborators have covered the entire subject and this volume alone contains 916 illustrations, many of them beautiful four-color plates. The omission of American references mentioned in the review of the second edition is still noticeably missing in the text but there is no bibliography in this volume and it is possible that this omission will be rectified in bibliographies included in later volumes. The question that comes to the mind of the reviewer "why can't American publishers produce a work of this kind?" is perhaps answered by the price of 288 marks which is charged for this volume alone. It is, after all, inconceivable that many copies of an American book could be sold at such a price and this despite the fact that the book is intrinsically worth it. While the specialists will find it absolutely essential to add this book to their personal library it is hoped that it will be made available for reference in every medical library in the country.

Translated by a radiologist and an orthopedist, this book by the French masters Leriche and Policard on The Normal and Pathological Physiology of Bone—Its Problems,[1] covers exactly the subject of its title. It does it completely and well and the authors have the courage of their convictions in that they take a definite stand on practically every controversial point. The reader will often disagree with the authors but he will find in this book the evidence on which the authors' opinion is based so that he may form his own conclusions. The subject is one of the utmost importance to surgeons and orthopedists and the book is so thorough and complete that we have no hesitancy in recommending it for inclusion in every medical library. A bibliography with about 250 titles and a good index complete one of the most satisfactory monographs we have seen in a long time.

The long awaited book[2] by Sicard and Forestier on lipiodol is now before us. It is a

[1] Roentgentherapie. Volume III. Lehrbuch der Röntgenkunde. By Hermann Reider and Josef Rosenthal. Leipz., J. A. Barth, 1928.

[2] Internationale Radiotherapie. Vol. III. Edited by J. Wetterer-Mannheim. Darmstadt, L. C. Wittich, 1928.

[3] Die Chirurgie der Brustorgane. By Ferdinand Sauerbruch and Others. Ed. 3. Vol. I, Part I. Berl., J. Springer, 1928.

[1] The Normal and Pathological Physiology of Bone. By R. Leriche and A. Policard. St. Louis, The C. V. Mosby Co., 1928.

[2] Diagnostic et Therapeutique par Le Lipiodol. By J. A. Sicard, m.d. and J. Forestier, m.d. Paris, Masson et Cie, 1928.

pity that this book is not available in English for it is the only authoritative source for definite information on a subject of the greatest importance to surgeons and roentgenologists. The book not only covers, as its title indicates, the question of diagnosis and therapeutics with lipiodol, but it goes thoroughly into the chemistry and physiological action of this important new subject. The fear at first entertained by American surgeons of the administration of a foreign substance into the spinal canal and having it remain there indefinitely has, according to the authors, been entirely overcome by the clinical experience showing definitely that it is absorbed and disappears in a reasonable length of time without leaving any harmful effect.

AN DER SCHWELLE DER CHIRURGIE[1] is a book of philosophical discources of a prominent French surgeon found worthy of translation into the German, than which no appreciation or praise could be higher.

The last few years have witnessed a distinct tendency in medicine to resurrect an interest in the patient himself as a biological entity, rather than to confine that attention to the particular disease or disorder with which he may be for the time afflicted. In this country, George Draper in his studies on human constitution has emphasized the relationship of the disease to the patient in the field of internal medicine; in Germany, Brugsch and Lowy, in a monumental and as yet uncompleted work, deal with the biology of the individual from every conceivable aspect. There has now appeared KONSTITUTIONSPATHOLOGIE IN DER ORTHOPÄDIE ERBBIOLOGIE DES PERIPHEREN BEWEGUNGSAPPARATES[2] which treats the question from the standpoint of orthopedics.

The first section of the book deals with a general statement of the present conception of heredity and genetics, and of the methodology of such investigations as they apply to the material under discussion. Then follow chapters on the biological aspects of the various orthopedic conditions, discussed in great detail, with numerous illustrative charts and tables.

The bibliography is exceedingly extensive. The collection of such widely scattered material represents a vast amount of patient research.

The book fills a real need. Those interested in the principles of orthopedic surgery will value it highly as an addition to the present knowledge of that subject.

According to the publishers, "This is the life-story of an unusual man, a man who loved animals and made them love him, who made pets of a fox, a coyote, a wild boar, who broke a pair of buffalo calves to harness, who won the confidence of a wild mother skunk, and who wrote accounts of his experiences that were no less true than fascinating, for if he loved the wild things he loved truth no less. All who are interested in wild life and its conservation, all who enjoy a well-told story of courageous and active life, will enjoy this book."

ERNEST HAROLD BAYNES[1] is divided into 14 chapters under the following heads: Fine Metal; A Youthful Naturalist; Leaving the Highway; No Place Like Home; The Fight to Save the Buffaloes; Lecturer and Letter Writer; A Champion for the Birds; Writing, Lecturing, and Acting; A Trip Abroad; Adventurers in the Eternal City and the Near East; The Fight for Truth; Sidelights; The Last Fight; Immortality. The one of interest to physicians and the one that the publishers overlooked in their blurb is number eleven "The Fight for Truth." In this chapter is told the work of Ernest Harold Baynes anti anti-vivisectionists.

Medical science never had a more ardent or able advocate than the subject of this biography. As executive head of "The Friends of Medical Progress," Ernest Harold Baynes, naturalist and lover of animals, fought the battle of scientific medicine with a vim, fervor and zest that invariably put to rout those usually well-intentioned but misguided souls who rally to the battle cry of antivivisection. That the question of vivisection has emerged from the debatable stage is largely due to Ernest Harold Baynes whose entire life exemplified the friendship of man for animals.

If for nothing else than as a token of appreciation from the profession for which he did so much, this interesting life of Ernest Harold Baynes deserves a prominent place in the library of every American physician.

A very exhaustive study of the problem of gonorrheal arthritis is to be found in

[1] AN DER SCHWELLE DER CHIRURGIE. By Emile Forgue. Leipzig, F. C. W. Vogel, 1928.
[2] KONSTITUTIONSPATHOLOGIE IN DER ORTHOPÄDIE ERBBIOLOGIE DES PERIPHEREN BEWEGUNGSAPPARATES. By Berta Aschner and Guido Engelmann. Berl., Julius Springer, 1928.

[1] ERNEST HAROLD BAYNES. By Raymond Gorges. Bost., Houghton, Mifflin Co., 1928.

LES ARTHRITES GONOCOCCIQUES[1]. It is a thorough discussion of the etiology, the pathological anatomy, the symptoms and the therapy recommended in this most dreaded affection of the joints. The author, a surgeon, gives an impartial account of all the opinions expressed in the literature and quotes views, and contradictory statements of the many men who have written on this subject.

The American physician will miss the more exact differential diagnosis between the true gonorrheal arthritis and the forms caused by Streptococcus viridans and similar organisms. Many cases described bear the earmarks of arthritis other then the gonorrheal one.

The discussion of the various treatments illustrates the disastrous habit of treating patients according to classifications, and for the purpose of demonstrating the value of a treatment the author offers interesting reading.

Though the writer as a surgeon is in favor of surgical interference he is very impartial in his judgment of others, no matter how skeptical he may be. He is impartial to a fault.

A complete list of the entire literature on this subject closes the book.

As a guide in the treatment of gonorrheal arthritis the book will fail most physicians, just on account of its fairness. As a book of reference it can hardly be surpassed.

The second edition of the monumental work KLINISCHE RÖNTGENDIAGNOSTIK DES VERDAUUNGSKANALS[2] appears with a preface by the famous Sauerbruch indicating its interest to surgeons as well as to roentgenologists. A complete, thorough, and well-written text on the roentgenology of the digestive tract, this book with almost 900 illustrations is produced in Springer's best style which leaves little to be desired.

A bibliography of 73 pages comprising over 2500 titles! There's testimony to the germanic *Gruendlichkeit* of the author, and this thoroughness is not to be questioned despite the fact that of the numerous articles by the American, Walter Alvarez, whose contributions may be considered classics of roentgen literature, only one was found worthy of citation. As against this there are listed 14 articles by James T. Case, 10 by A. R. Carman and 2 by F. W. Manges, indicating that American literature has not been entirely slighted.

There can be no question but that this book is an invaluable addition to the library of the roentgenologist and also of great value to the surgeon.

The author and the publisher of the delightful book TROUBLES FONCTIONNELS ET DYSTROPHIES A L'ETAT CHRONIQUE EN GYNECOLOGIE[1] have turned out an unusually good piece of work. The anatomic and physiological division is concise and clear-cut, and of value to all students of the subject. A section deals with neurophysiology and could well be studied by all gynecologists and endocrinologists. The operative suggestions would hardly be accepted in toto by American surgeons, but are interesting and give much food for thought.

The pictures of uterograms contained under the heading of "Treatment" are not quite as clear as one might desire, and the conclusions from these roentgen-ray studies are not entirely satisfactory. The pictures of operations on the cervix are unusually good. About fifty pages are devoted to roentgen-ray diagnosis and cover the subject quite fully. At the back of the book are some thirty pages of drawings of various operative procedures, and they are very clear-cut and extremely instructive. The book has undoubted value for both the student and the specialist along this line of work.

[1] LES ARTHRITES GONOCOCCIQUES GONORRHEAL ARTHRITIS). By H. Mondor. Paris, Masson et Cie, 1928.

[2] KLINISCHE RÖNTGENDIAGNOSTIK DES VERDAUUNGSKANALS. By H. Chaoul, M.D. Edited by E. Stierlins. Berl., Julius Springer, 1928.

[1] TROUBLES FONCTIONNELS ·ET DYSTROPHIES A L'ETAT CHRONIQUE EN GYNECOLOGIE. By Paul Petit-Dutaillis. Paris, Gaston Doin & Cie, 1928.

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EMERGENCY BLOOD MATCHING, TYPING & TRANSFUSION*

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IT almost goes without saying that under ordinary circumstances one who proposes to perform blood transfusion should either himself be a competent laboratory man or avail himself of the services of a well-trained and reliable laboratory consultant with respect to preliminary testing of the bloods which he proposes to mix, in order to make sure that they are compatible. Occasionally, however, it is highly desirable that the transfusionist, although not a general laboratorian, should himself be able to perform the necessary preliminary tests, especially in an emergency. Furthermore, blood transfusion being in many cases an emergency procedure and one which may become a great desideratum in places far removed from elaborate laboratory facilities, a simple technique, provided it be reliable, would seem to have value.

The process of determining compatibility is not really a difficult one and can be mastered with very little effort and the expenditure of a moderate amount of time. It does not, of course, necessarily involve the determination of the blood group of either donor or recipient, but consists in its simplest form merely of testing the agglutinating power of the recipient's serum upon the donor's red blood cells. About one-third of random transfusions

give severe reactions because of incompatibility, and about 5 per cent are of such severity as to prove fatal or at least seriously to jeopardize the life of the recipient. The simple procedure of determining that the cells of the donor will not be agglutinated by the recipient's serum makes transfusion virtually 100 per cent safe, since the dilution of the donor's serum in the total blood volume of the recipient seems practically to negate the possible ill effects of the converse effect, viz., the agglutination of the recipient's cells by the donor's serum. To test the agglutinating power of the donor's serum for the cells of the recipient is, however, as simple as the reverse, and accordingly, in case there is a choice of donors and it is desired to make use of the most suitable one, both processes may and should be performed.

The process of "direct matching" is satisfactorily performed by the following simple method, which requires only normal saline solution, glass slides and coverslips, small test-tubes and capillary pipettes, which latter may be readily fashioned from glass tubing by "drawing out" the latter in the flame of a Bunsen burner. These pieces of paraphernalia are available to almost any practitioner, however far removed he be from a laboratory center.

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* From the Department of Surgery, School of Medicine, Tulane University, New Orleans.
Submitted for publication January 28, 1929.

Sufficient blood for both tests may usually be obtained from both donor and recipient by puncturing the lobe of the
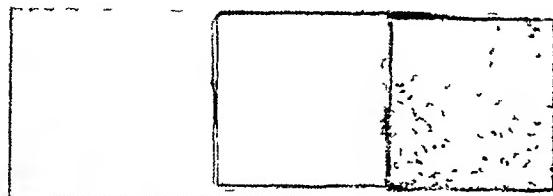
FIG. 1   Positive agglutination (brick-dust appearance) on right and negative agglutination (homogeneity) on left. (Note that due to spreading of one preparation into other at margin between two coverslips *a very slight amount of agglutination is seen in* left-hand preparation.)

ear or the finger but occasionally venipuncture may be required. A large drop or two of blood is allowed to fall directly into about 5 c.c. (the exact amount is of no moment) of normal saline solution in a test-tube, and as much more as can be conveniently obtained is allowed to fall into the bottom of a second dry test-tube. The tube of blood in saline is either simply placed aside to settle or is centrifuged (providing facilities for the latter purpose be at hand); the tube containing blood alone is set aside to coagulate.

If "cross matching" is to be performed, i.e., both the testing of donor's cells against recipient's serum and recipient's cells against donor's serum, a pair of such tubes is prepared from both donor and recipient. If "simple matching" only is desired, i.e., the testing of the donor's cells against the recipient's serum, blood in saline is taken from the donor and unmodified blood from the recipient.

After centrifrugalization of the blood in saline or after the cells have completely settled to the bottom of the tube the supernatant saline is withdrawn with a pipette and discarded. This process removes the donor's native serum and provides washed red cells. About 10 volumes of fresh saline solution are now added to make a 10 per cent suspension of red cells; this percentage does not need to be exact, but it is fairly easy to estimate

with accuracy, since if one drop of blood was used originally and not too much of it was lost in the process of washing, about 9 drops of saline would of course be required.

The clot having retracted in the tube of whole blood set away to coagulate, a drop of clear serum is now sucked up into a clean capillary pipette and delivered to the surface of a clean glass slide. If the recipient's serum has been taken, a drop of the donor's cell suspension is now similarly sucked up in a clean pipette and is added to the drop of serum, both being mixed together. The slide is kept in a warm place for at least a minute (it is not safe to read a negative reaction in less than three minutes), and is then observed against a white background; one of the best ways to do this is to place a clean white sheet of paper upon the table upon which one is working and make the observation against this by holding the slide between the fingers and about 2 in. above the surface of the paper.

Lack of agglutination is manifested by the maintenance of homogeneity in the smear, agglutination by the assumption of an appearance which has been likened to "brick dust;" i.e., the red cells become grouped together in small red clumps. Usually there is no doubt as to whether the reaction is positive or negative. At this stage however, in case of doubt, the simple expedient of gently covering the preparation with a coverslip will settle the matter definitely, since the latter procedure emphasizes the size of the conglomerated particles which occasionally, as a result of this manipulation, approach the size of the head of a pin. This magnifying effect does not occur in case inversion of the coverslip is made immediately after the preparation is placed on the slide, so that the directions should be followed precisely as outlined. Figure 1 represents the appearance of both negative and positive agglutination reactions when brought side by side on a single glass slide.

In the event that any shadow of doubt remains as to the reading of a given

suspected positive, a definite negative reaction may, of course, be prepared for comparison by mixing cells and serum both from the same specimen.

The process of matching recipient's cells against donor's serum proceeds in exactly the same manner. Completely compatible bloods show both reactions negative, but in case the recipient's serum does not agglutinate the donor's cells the transfusion may proceed without much risk. If the recipient's serum does agglutinate the donor's cells, the only circumstance that would prevent a serious or even fatal reaction would be failure of hemolysis to ensue upon agglutination.

Blood grouping, though not a more formidable undertaking, is of less value than direct matching in any actual transfusion, since untoward reactions are possible, even though grouping is accurately determined, incompatibilities having been demonstrated within groups. However, in case grouping becomes desirable, as in cases in which it is desired to classify donors for future emergencies or to determine the likelihood of compatibility of persons at a distance, the grouping of which is already known, such a procedure is entirely feasible with no other equipment than has already been described, providing only the blood group of the operator himself or of some other available person be accurately known to be of either Group II or Group III.

The technique proceeds precisely as in "cross-matching," i.e., the serum of the person of the known blood group is mixed with the red-cell suspension of the unknown and vice versa, and the reactions are read. The blood group of the unknown appears as the result of a process of logical deduction, e.g.:

Example 1. The known blood belongs to Group III. By cross-matching it is found (1) that the serum of the known specimen agglutinates the cells of the unknown specimen; (2) but that the cells of the known specimen are not agglutinated by the serum of the unknown specimen.

Process of deduction (using Jansky's classification):

A. The serum of Group III is known to agglutinate the cells of Groups II and IV only, so that the unknown blood must belong to one of these.

B. The cells of group III are known to be agglutinated only by groups I and II.

C. The only group which is common to both A and B, i.e., that fulfills the conditions actually found, is Group II; consequently the unknown must belong to Group II.

Example 2. The known blood belongs to Group II. By cross-matching it is found (1) that the serum of known specimen does not agglutinate the cells of the unknown; (2) neither are the cells of the known specimen agglutinated by the serum of the unknown.

Process of deduction (using Jansky's classification):

A. The serum of Group II is known to agglutinate the cells of groups III and IV only, so that the unknown must belong to either Group I or II.

B. The cells of group II are agglutinated only by Group I and Group III.

C. The only group which is common to both A and B, i.e., that fulfills the condition actually found is Group I; consequently the unknown belongs to Group I.

Reasoning the various possible combinations through in this manner Table I can be constructed and will serve for rapid

TABLE I

	Serum of Known and Cells of Unknown	Cells of Known and Serum of Unknown	
GROUP I	− (I)	− (I, II, III, IV)	I
		Does not occur	
	+ (II, III, IV)	− (I, II, III, IV)	No conclusion
		Does not occur	(II, III, or IV)
GROUP II	− (I, II)	− (II, IV) + (I & III)	II I
	+ (III, IV)	− (II, III) + (I, III)	IV III
GROUP III	− (I & III)	− (III & IV) + (I & II)	III I
	+ (II & IV)	− (III & IV) + (I & II)	IV II
GROUP IV	− (I, II, III, IV) + Does not occur	− (IV) + (I, II, III)	IV

reference. In the interests of completeness the table is also worked out for Groups I and IV, in order to show why these two

and one which is quite simple, would seem to be of value. Such a method almost of necessity requires the use of an anti-
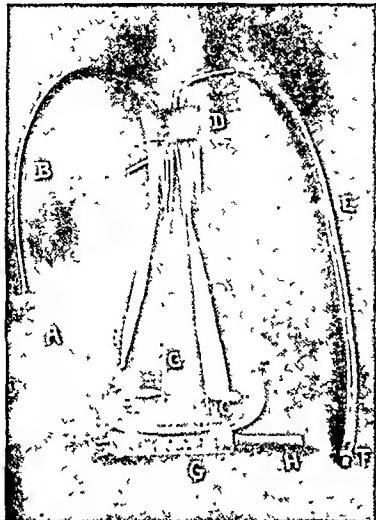
FIG. 2. FIG. 3. FIG. 4.

FIG. 2. Photograph of simple apparatus for blood transfusion partly assembled. A larger syringe (20 c.c.) may be used.

FIG. 3. Enlarged photograph of rubber stopper and glass tubes shown in Figure 2. Lettering corresponds with that of Figure 2.

FIG. 4. Photograph of same apparatus as Figure 2 and Figure 3 but assembled for sterilization. Note sodium citrate solution in bottom of flask and scratch mark on glass indicating volume of 500 c.c.

blood groups cannot be used for the purpose under discussion.

Many methods for the actual performance of blood transfusion have been devised, some of which are relatively simple, others fairly complicated. Many require specially prepared and fitted metal valves; others make use of special types of glassware. Most of the various specially prepared pieces of apparatus have points of advantage and accordingly have attracted to themselves advocates, in the hands of whom they give excellent results.

For the performance of emergency transfusion, however, a procedure which frequently must be undertaken under adverse circumstances and which, in any case, is likely to be required at the hands of one not especially skilled in any particular method, or in a place where special equipment is not to be had, a method which requires merely such apparatus as can usually be obtained wherever any laboratory apparatus at all is obtainable,

coagulant because the use of such a substance enables one man to perform virtually the entire technique, while at the same time doing away with the necessity for haste or at least the amount of expedition commonly required in methods using whole blood, which coagulates in a relatively short time.

Other things being equal, for the performance of any relatively unfamiliar technique the fewer pieces of apparatus required the better. An apparatus for transfusion of this type, using sodium citrate as an anticoagulant and meeting the requirements of simplicity and relative availability of material is illustrated herewith.

The reservoir into which the blood is withdrawn from the donor and which also serves to hold it until it is delivered to the veins of the recipient is an Erlemeyer flask of 1 liter capacity (Fig. 2). A two-holed rubber stopper, D, of such size as accurately to fit the neck of the flask is

prepared as shown in Figure 3; a short piece of glass tubing, E, is bent to a right angle and pushed through one hole of the stopper so that it just protrudes (see small arrow); another slightly longer piece of glass tubing (B in Fig. 3) is bent as shown at the long arrow, the tube then being pushed through the other hole of the stopper, this time from below upward, and is subsequently bent to a right angle to correspond, above the stopper, with the shape of the first right-angled piece. Holes are now bored into but not all the way through the stopper from below upward to receive and hold tightly the two pieces of solid glass rod, C and C¹. The glass rods are cut of sufficient length to reach almost to the bottom of the flask when the stopper has been fitted to it.

In order to insert the stopper thus prepared the free ends of the glass rods are gently brought toward each other, the elasticity of the rubber stopper facilitating this manipulation; as soon as the rods have been brought virtually into parallelism they can be inserted into the flask and as the stopper is pushed into the flask they flare again to the divergent position they formerly occupied.

Referring again to Figure 2, the remaining essential parts of the apparatus are two pieces of rubber tubing, B and E, the former about 9 in. in length and the latter somewhat longer; both pieces of rubber tubing carry on their free ends needle-adapters.

When using the apparatus sufficient sodium citrate solution is placed in the flask to prevent the coagulation of the amount of blood which it is proposed to withdraw and inject. The sodium citrate is prepared in 2 per cent solution in normal saline, and 10 c.c. of this solution is added for every 100 c.c. of blood to be transfused. This makes the resulting dilution of citrate 0.2 per cent, which is ample to prevent coagulation.

The apparatus and solution are rendered sterile, as will subsequently be described. When it is desired to perform transfusion the flask is momentarily inverted so as to fill tube B and its attached needle with citrate solution; the flask is then turned right side up and needle A (attached to tube B) is thrust into a vein of the donor, blood being allowed to flow into the flask. The apparatus is designed, as will be seen, to provide as short a piece of tubing as possible from donor to flask, so as to minimize the possibility of coagulation within the tube. The bend in the glass tubing at the arrow conducts the blood stream to the side of one of the solid glass rods down which it trickles, thus avoiding a considerable drop from the stopper to the bottom of the flask and the consequent danger of foaming of the blood as it accumulates. During the process of withdrawing blood the flask is twirled, the solid glass rods acting as stirring rods. If the blood trickling down the glass rod shows a tendency to flow slowly the precaution of tilting the flask so as to bathe the rod in the blood-citrate solution already present will prevent coagulation on the rod.

When sufficient blood has been obtained the needle is withdrawn from the vein of the donor, disconnected from the apparatus and discarded. The flask is gently rotated so as to keep mixing the contents until ready to inject the blood into the veins of the recipient. For the latter purpose a needle is attached to the needle adapter F and the flask is inverted, being careful to keep the end of the tube B up so as to prevent spillage of blood through it. As soon as air has been expelled from tube E and its attached needle and this part of the apparatus is full of blood, the needle may be inserted into the vein of the recipient, and injection proceeds by gravity.

The glass syringe G and the rubber tube connection H are sterilized attached to F. Suction may be exerted by means of the syringe during the withdrawing of blood if necessary, or be removed and laid aside, but in any case the piece of rubber tubing serves the purpose of maintaining the sterility of the needle adapter. Similarly, syringe and rubber tube may be

applied to B for the purpose of exerting pressure during subsequent injection of the blood.

The apparatus completely assembled and ready to be finally wrapped for sterilization is illustrated in Figure 4. The flask in the photograph is marked to indicate when 500 c.c. of blood have been withdrawn, this being the size of the ordinary blood transfusion, but other graduations may, of course, be added or substituted if desired. Sterilization is best effected by autoclaving. Some will possibly object to the addition of the total amount of citrate at first on the grounds that as little citrate as possible should be used and that accordingly it should be added a little at a time, as more and more blood is withdrawn, in order to obviate an excess amount of citrate in case not all of the blood originally expected is obtained; this would be a valid objection if there were any real evidence that sodium citrate is a harmful substance. If the objection be dcemcd valid, however, in spite of this, citrate solution may, of course, be added to a previously unprepared apparatus such as this by means of the syringe provided in amounts as large or as small as one wishes.

It is, of course, true that various attacks in the past have been launched against sodium citrate on the score of toxicity but none of them have been substantiated by more recent investigations. It seems well established that virtually all of the sodium citrate introduced into the blood stream in the course of a transfusion is eliminated in a very few minutes, that it has no demonstrable harmful effect on any of the blood elements, and that, far from increasing the coagulation time of the recipient's blood, it actually increases its coagulability.

Rubber tubing and rubber stoppers should be carefully scrubbed and boiled before being used as part of any transfusion apparatus for fear of reactions which might result from the use of new rubber. Although reactions are supposed to occur more frequently when using sodium citrate as an anticoagulant than when using unmodified blood, the performance of citrate transfusion in many thousands of cases during the past fifteen years has demonstrated that the method is safe, and it is probably true that most of the bad effects attributed to sodium citrate in the past have been actually due more to faulty technique than to drug action.

INGROWING TOE NAIL[*]

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THIS is a condition in which the lateral edge of a nail has become imbedded in the adjacent soft parts of the lateral nail groove, giving rise to an inflammation of the matrix and soft parts about the nail.[1]

A proper knowledge of this disease and its treatment must commence with a study of the anatomy of the region. A nail is a portion of the epidermis modified for special function. It has a root, which is implanted into a groove in the skin; a body, which is the exposed portion; and a free edge.

The portion of cutis beneath the root and body is called the matrix, because it is the part from which the nail is produced.[2] In reality the nail grows from a thick layer of epithelial cells above and below the nail, the former extending nearly to the reflection of the skin and the latter to the white semilunar line.[3] The distal half of the matrix is thinner, more fibrous and less vascular.

The cuticle is attached to the surface of the nail in advance of its root and to its under surface a little behind the free edge. The successive growth of new cells at the root and under surface of the body causes the nail to advance forward and maintain its shape. The great toe nail takes about six months to travel its entire distance.

An ingrowing nail is largely a disease of civilization caused by one of the following:

A. Bad shoes.
   1. Too short.
   2. Too pointed.
   3. Not a straight last.
   4. Too narrow at the toe.
   5. Low stiff cap.
   6. High heels.
B. Bad stockings.
   1. Too short.
   2. Too tight at the toe.

c. Bad trimming. Not straight across and too short. Pressure on the end of a long nail makes the edges bend upward. The edge of the nail should rest on the hard skin at the end of the toe and not on the tender skin at the sides in the nail bed.

As a result of unfavorable surroundings the edge of the nail is forced downward and inward into the soft parts; the nail becomes thicker and more curved, an ulcer forms at the edge and infection with exuberant granulations follows.

When fully developed we have onychia and paronychia, i.e. an inflammation of the matrix and soft parts about the nail. This may occur in any toe but is most common at the outer side of the great toe.

The diagnosis is usually evident, but ringworm should be borne in mind as an occasional cause of error.

Prophylaxis consists in good shoes and stockings from birth.

Relief may be obtained from the milder varieties of ingrowing nail by purchasing longer shoes with a high soft cap, straight last, broad toe and low heel. In addition to this the best treatment for many of these nails is a thinning of the entire body of the nail by a small emery wheel such as is used in the offices of many chiropodists. This makes the keystone of the nail arch soft and flexible and prevents excessive pressure on the nail groove and also promotes outflaring of the sides of the nail. I know one individual who regularly prevents trouble each year by having his great toe nails ground down before starting off on a strenuous two weeks' golf trip.

If necessary the edge of the nail may be lifted by inserting cotton beneath it with the flat end of a probe. Foote advises wetting the cotton with 1:50 silver nitrate solution. Crane advocates dentist's base plate gutta percha which he claims pos-

FIG. 1. Toe.

FIG. 2. Nail. Soft parts turned back.

FIG. 3. Matrix. Nail removed.
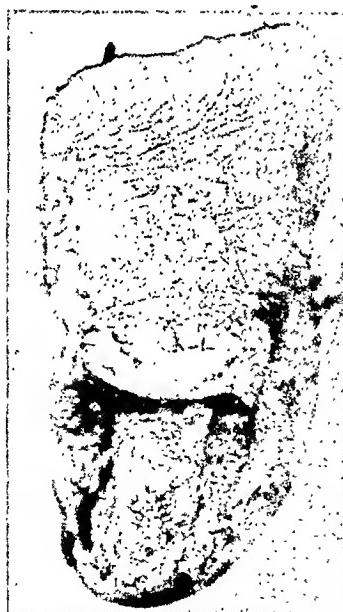
FIG. 4. Phalanx. Matrix removed.

FIG. 5. Incision for operation. Strip of nail and matrix re-moved.

FIG. 6. Nail removed to show amount of matrix that should be removed.

sesses decided advantages over cotton. A small triangular piece is cut and heated in the flame and then inserted beneath the edge of the nail. It molds itself to the shape of the nail and may be left until the nail grows in the correct direction.

For temporary relief, in an emergency, when much walking is necessary, a quarter-inch strip may be split·up the entire side of the nail with sharp pointed scissors and the lateral piece pulled out or the offending corner only cut away. This is usually poor treatment as the pain and pressure will quickly recur as the nail again advances.

In mild cases with people of intelligence Foote recommends a thin strip of spring silver bent to hook under the edge of the nail and half encircle the toe to the plantar surface. It is held in place by adhesive plaster. As the patient steps on the toe the nail is lifted upward.

Radical treatment consists of removal of the side of the nail and the corresponding matrix by operation. This may be done under nitrous oxide anesthesia or by novocaine block. An elastic band is tightly drawn about the base of the toe to ensure perfect hemostasis. A vertical incision is then made about $\frac{3}{8}$ inch from the lateral edge of the nail and parallel to the nail groove. This commences about $\frac{1}{4}$ inch below the joint surface, at the root of the nail, and is carried down to the bone by a single sweep of the knife, terminating at the tip of the toe and the free edge of the nail (Fig. 5).

Next the blade of the knife is inserted into the incision down to the bone and a lateral twisting motion carries the cutting edge laterally outward between the matrix and the bone, turning the matrix and soft parts upward upon a hinge. Then the tip of the matrix is grasped with a mouse tooth forceps and, with the point of the knife, is carefully dissected upward and outward, cutting it away from the bone and soft parts but taking a thin layer of the cutis with the matrix, especially at the upper end near the root because at that point the nail grows from cells "above and below" (Fig. 6).

No sutures are used. The flap of skin is carefully held up in place against the cut edge of the matrix and nail by a bandage, which is applied firmly but not too tight, before the elastic band is removed.

The dressing should be changed in a day or two after thorough soaking in an antiseptic solution and great care should be used not to tear the flap loose. Later a shoe with the cap cut away is worn and, finally, when healing has taken place · (from one to three weeks, depending upon the amount of infection present) the patient is fitted with loose stockings and a long shoe with broad toe, high cap, low heel and straight inner line.

Other methods of treatment for ingrowing nail have been advocated. They may be also good but those described above will give satisfactory results if properly applied.

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OFFICE TREATMENT OF
ENDOCERVICITIS*

HARVEY BURLESON MATTHEWS, M.D., F.A.C.S.

BROOKLYN

PREVENTIVE medicine is the order of the day. Most every individual and a great many organizations throughout the world are interested in the prevention of disease. Modernity requires this.

In the prevention of most of the infections of the cervix we must begin with the delivery of the child. Prevention at this time may be accomplished or minimized first by obtaining complete dilatation of the cervix before delivery, or attempts at delivery; secondly by keeping the membranes intact until full dilatation of the cervix is obtained; and finally by making the actual delivery of the child as nearly normal as possible. Dry labor is always more exhausting to the mother and likewise more traumatizing to the cervix. Under any condition, when a full-term child passes through a cervix, it is lacerated, either microscopically or macroscopically, usually macroscopically. The degree of laceration does not make very much difference so far as infection is concerned, because, as is well known, there are myriads of pathogenic and non-pathogenic bacteria in the vagina which immediately enter through such lacerations, whether they be microscopic or macroscopic. So that if we take plenty of time for complete dilatation of the cervix, preserving the membranes until full dilatation shall have been accomplished, we do all that is possible towards preventing trauma, and in the prevention of trauma we inhibit or minimize infection. Furthermore if moderate or extensive lacerations of the cervix are repaired immediately after delivery we minimize or prevent the entrance of infection. This should therefore be done when possible.

It must be remembered also that gonorrheal infection in the nulliparous cervix (multiparous too!) is a very common occurrence and calls for very active treatment.

With all our admonitions regarding the prevention of infections of the cervix, we still have chronic endocervicitis occurring in about 75 per cent to 85 per cent of the women seen in hospital and private practice.

How shall we treat endocervicitis? There are several recognizable groups of these cervices and it seems to me that the treatment can be more clearly outlined if we place all infected cervices into four groups, depending upon the pathology present. They are the following:

Group I. The recently lacerated cervix (of only four to twelve weeks' duration) with superficial infection.

Group II. The lacerated, eroded cervix of three to twelve months' duration, i.e. somewhat more deeply infected than Group I, with more or less eversion and few if any cysts.

Group III. The lacerated, everted, eroded cervix of two to five or more years' duration, i.e. moderately deeply infected and with or without visable cysts.

Group IV. The old lacerated, everted, cystic, usually eroded, cervix, deeply infected and of long duration (ten to forty years).

Now having arbitrarily divided all infected cervices into these more or less recognizable groups, let us proceed with the treatment for each group.

GROUP I. Often in this early group we find a retroverted uterus, few weeks postpartum, that should be corrected. When corrected and held in place with a

pessary, involution of both uterus and cervix is stimulated and hence the cervical discharge is lessened. Local applications

plished and the cervix is now a normal looking multiparous cervix free of infection and therefore of discharge. (Fig. 2, No. 4.)
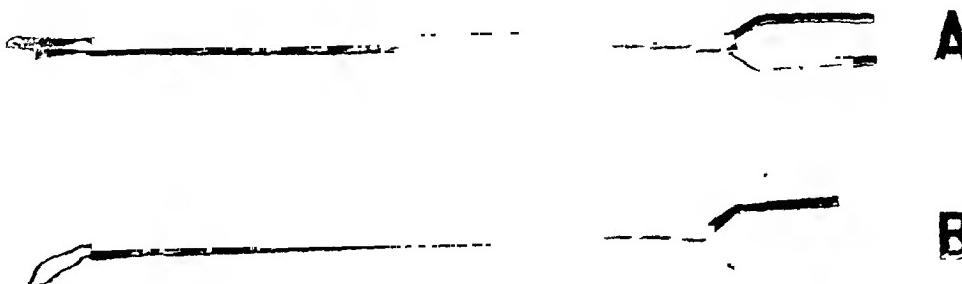
Fig. 1. Nasal type of cautery. A. Blade tip, generally used for striping or flat cauterization. B. Wire loop used for puncturing cysts. It may also be used for striping as in A.

of silver nitrate "stick" or 20 per cent to 40 per cent solution once a week, using an alkaline cleansing douche (sodium bicarbonate, borax, or sodium chloride, 4 drams to 2 quarts of hot water) once a day followed immediately by the knee chest position for five to ten minutes, will destroy superficial infections and promote kindly healing of the lacerated tissues. Tincture of iodine or 4 per cent to 10 per cent mercurochrome may be used with success. Far better, however, than any local applications, even in the treatment of these early cervical lesions, is the electric cautery. Using the small nasal type cautery with the small blade or looped wire (Fig. 1, A and B) "striping" the lacerated eroded surface (Fig. 2, No. 1). The "stripings" are placed about 1 cm. apart and extend 3 to 5 mm. deep, both lips being "striped" at the first sitting. In these early Group 1 cases merely cauterizing the "erosion" with the flat surface of the cautery blade often suffices. Mercurochrome 4 per cent should be painted over the cauterized cervix and a cleansing douche should be taken twenty-four hours later and repeated daily thereafter. I rarely use vaginal tampons in this type of office work having never been convinced of the accredited value of them. In two to four weeks there is no sign of erosion. Inversion rather than eversion has taken place. Healing has been accom-

Group II. In this group the infection has gone deeper into the cervical tissues, particularly the mucous membrane and glands, hence the topical applications are *absolutely useless.* Do not use them. The ideal and successful method is the cautery method. The technique of striping is the same as in Group 1, except that in this group the cauterization must be deeper and more extensive. Begin by cauterizing only one lip at a sitting. The striping must extend from high up in the canal (to or nearly to the internal os), out over and through the everted, eroded area to normal cervicovaginal mucous membrane, 1 to 1½ cm. apart and 5 to 7 mm. deep (Fig. 3, No. 1). The remaining lip may be cauterized in two weeks. When healing has completely taken place in eight to sixteen weeks we have a fairly normal appearing multiparous cervix with very little if any discharge. (Fig. 3, No. 3.)

A note of warning should be sounded regarding striping (cauterization) in the canal of the cervix, for if too much of the mucous membrane with its epithelial covering is destroyed epithelialization cannot take place in a normal manner and hence stricture and even stenosis will be the result. "Long islands" of epithelium must be left *in situ*, otherwise re-epithelialization of the cervical canal cannot take place. The pencil type cautery therefore should never be used in this type of work.

GROUP III. This is the borderline group. Oftentimes the cautery is not successful in this type of chronic infection with cyst a low grade subacute parametrial inflammation. Be very cautious and always try to eliminate such danger. Naturally any
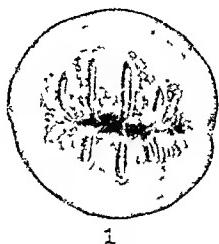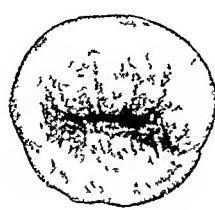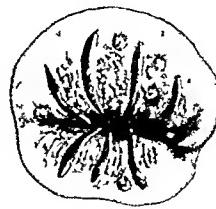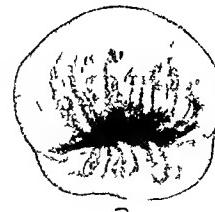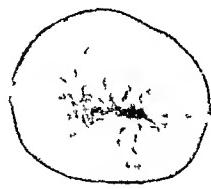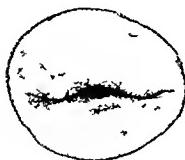
FIG. 2. Method of striping and process of healing. Cervix exposed and held in place by ordinary bivalve speculum. Small fine single tenaculum helps mobilize cervix, but is usually not necessary. Cautery tip (Fig. 1, A) heated to white heat (never blazing red) before making stripes or puncturing cysts.

FIG. 3. Similar to Figure 2, except stripings are much deeper and cauterization generally more extensive due to longer standing and deeper seated infection. All visible cysts are punctured after method shown in Figure 4.

formation. Experience counts a great deal in this group. Careful, thorough and deep cauterization is called for if success is to follow. For the beginner failure is likely. For one experienced in cauterization complete or partial success is pretty sure to crown his efforts. Some form of local anesthesia may have to be used, particularly for the inexperienced hand that misdirects the hot cautery tip and causes pain in an already apprehensive patient.

Furthermore there is likely to be some parametrial reaction following this type of cauterization and hence rest in bed for two or three days is in order. A warning must be given in this connection, viz: Never cauterize this group in the presence of acute or subacute inflammation. Marked systemic as well as local reaction sometimes follows. In fact in all cautery work acute inflammatory lesions in the pelvis are very strict contraindications to the use of the cautery. I have seen within the week a very acute fulminating parametritis as the result of cauterizing the cervix in the presence of

FIG 4. Method of puncturing cysts. May be used alone or in conjunction with stripings as shown in Figures 2 and 3. This method is particularly applicable to nulliparous cervix, especially gonorrheal. Note small size of wire cautery tip May also be used to destroy latent infection or abscess of Skeene's glands.

therapeutic agent can be misused by the man who does not know its limitations. Why blame the method? Diagnosis is still

the most important phase of the practice of medicine, for without an accurate diagnosis no form of intelligent treatment can be carried out.

Group IV. We have now to say a word about Group IV. This is the hopelessly infected cervix of long duration that nothing short of the removal of the infected area by the Sturmdorf cone operation or by amputation will relieve the discharge. The cautery, that is the office cauterization, cannot remove the infected area and therefore will not relieve the leucorrheal discharge. Do not try the cautery in these cases. Operate upon them. Of course under full anesthesia it is possible to amputate a cervix with the cautery; however I prefer operation. Better healing and less scarring is obtained by operation.

The infected nulliparous cervix (gonorrheal or other infection) may be treated successfully with the cautery. In the earlier stages after all acute symptoms have subsided stripings similar to those for Groups II and III may be carried out. Any cysts may be punctured as illustrated in Figure 4. Early cases properly cauterized give excellent results. Late cases with many deep cysts are not so successfully handled with the cautery but are improved, depending upon the thoroughness with which the cautery is used. Since these cases often come for the relief of sterility as well

as leucorrhea, any form of treatment that will give at least some relief is commendable. Operations on such cervices, especially amputation, is certainly not to be desired. In fact amputation of the cervix during the child-bearing age is absolutely contraindicated, except under very special circumstances.

In conclusion I should like to stress the following points:

1. Prophylaxis as regards the prevention of lacerations and infections of the cervix is most important.

2. In the recently lacerated and traumatized cervix, local applications of silver nitrate, tincture of iodine, 4 per cent mercurochrome and other germicidal agents, together with alkaline vaginal douches, inhibit but oftentimes fail to prevent the progress of the infection. The cautery works wonders. Try it.

3. For the early erosions and superficial infections of the cervix the cautery treatment, by all odds, gives the best results.

4. When the infection is of longer duration with cyst formation, the judicious use of the cautery still gives the best results in office work.

5. In the infections of very long durations, with deep seated infection and marked cystic formation, the cautery is of little or no use. Operation must be resorted to.

WARTS, MOLES & CORNS*

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WARTS and moles are worthy of serious attention by the physician and should not be considered as mere cosmetic defects to be treated by the beauty parlors. Corns are of much less importance and seldom require the aid of a physician. The recognition of warts, moles and corns is usually easy, though it is difficult at times to distinguish between certain types of warts and moles. In spite of the great frequency of these lesions we have much to learn of their causation. The majority of warts appear to be infectious though no specific organisms have as yet been discovered. Common warts at least have been experimentally produced by a filtrable virus. As to the cause of moles, we merely know that they show a marked hereditary and familial tendency. The real cause of moles, as of all other birth-marks, is unknown. Corns constitute a reaction to pressure and tend to remain as long as this continues. The chief interest in this subject is the treatment, which will be considered at some length.

WARTS (VERRUCAE)

There are several varieties of warts which present very dissimilar appearance, some of them (flat warts, plantar warts) often failing to be recognized as such by the average physician. A discussion of this subject will not include the verrucous changes that occur in certain skin diseases such as tuberculosis, nor will it include the infectious disease seen in parts of South America, known as verruga peruana. Six types of warts will be considered: common, filiform, plantar, flat, acuminate and senile warts.

1. The *common wart* (verruca vulgaris) is the familiar type occurring most often on the back of the hands or fingers of children. Like other types of warts it is a benign epithelial neoplasm and not an inflammatory affection. It is true, however, that warts may at times become secondarily inflamed as shown by a reddish areola and tenderness. Common warts vary in size from a pin head to a small bean and may become more or less confluent. They are sharply defined, have a rough mammillated surface which may become very hard in lesions of long standing. The base may be somewhat constricted and almost pedunculated. They may be single or multiple. While seen most often on the hands, they often occur in the nail folds and also on the face, scalp or any region, including the mucous membranes. The common wart may be associated with other types of warts and in rare instances may be the starting point of malignancy. While children are most often affected, the disease is also seen in young adults, less often in later years.

A variation from the classic common warts is known as the digitate wart, which consists of a "group of separated finger-like projections arising from a common base" (Pusey). This lesion differs from the ordinary type in its greater hypertrophy of the papillae.

In treating common warts it should not be forgotten that they eventually disappear spontaneously. They have been known to disappear apparently from the mental effect of suggestion. At any rate their duration is extremely variable and capricious. It is therefore proper to avoid scarring as far as possible in their removal, especially as the majority occur on exposed parts of the body. Massive doses of roentgen rays or radium, with close screening of the surrounding skin, will cure a minority of common warts. This method

of treatment, if successful, is ideal, as it is painless, causes no scarring and affords no opportunity for infection. In a few cases of multiple warts on the back of the hands and fingers, I have seen the lesions disappear rapidly after a single dose of 1 "skin unit" roentgen rays, applied without screening the individual lesions. When irradiation fails I prefer to use electrodesiccation (monopolar Oudin current). With this method care must be taken to use a small spark which will not extend beyond the lesion to be treated. Local anesthesia may be used, especially for warts affecting the nail folds, where this method of treatment is decidedly painful. Great care must be used not to overtreat an anesthetized lesion and produce unwarranted scars. Caustic potash is a favorite remedy of some of my colleagues, the surrounding skin being protected with vaseline. I have not been successful with carbon dioxide snow, though freezing by liquid air, which is now easily obtainable, is highly recommended by Irvine. The latter uses this remedy intermittently for three minutes with success. Salicylic acid has long been used for warts, though my experience with this keratolytic agent has not been very satisfactory. I would certainly never recommend nitric acid, on account of its well-known tendency to produce keloidal scars.

2. The *filiform wart* (verruca filiformis) is a thin, flexible, thread-like body which consists of one or of several hypertrophied papillae. This type of wart may be single or multiple and occurs most frequently on the neck and face, often about the eyelids. It is easily removed by a sharp curette, after which the base should be cauterized with silver nitrate stick.

3. The *plantar wart* (verruca plantaris) is seen on the bearing surface of the feet (toes, ball of foot and heel). From a casual glance it resembles a corn or small callus. Careful inspection however shows it to consist of grouped filiform hypertrophies with a hard elevated border. Plantar warts are always painful, often extremely so, and interfere seriously with walking or dancing. They are single or multiple and may be associated with other types of verrucae. They are unquestionably communicable and often affect a large number of boys or girls in boarding schools. It seems probable that they are carried from one to another by walking barefoot in the gymnasium or swimming pool.

The best treatment for plantar warts in my opinion is by the roentgen rays, this method being successful in the majority of cases. It is my practice to give one exposure of 3 "skin units" of unfiltered rays, screening the individual lesion with lead foil as closely as possible. With this dosage it is not advisable to pare the lesions previous to irradiation. I have never seen any ill effects from this method, though it is not always successful and may have to be repeated once or twice after intervals of five or six weeks. When the roentgen rays fail, the lesions may be excised or removed by electrodesiccation or other destructive methods. The advantages of treatment by the roentgen rays are that there is no pain, no danger of infection and the patient is not compelled to remain off his feet for a week as after excision.

4. The *flat wart* (verruca plana juvenilis), as its name would imply, is seen most often in children, though it also occurs in adolescent girls and young women and in men upon the bearded region. The lesions are usually multiple and may be numerous, one or two hundred being present at times. Flat warts are of pinhead size with smooth or slightly scaly surface and round or polygonal base. They are mostly discrete but may coalesce to form small patches. The color is that of normal skin or slightly yellowish. Flat warts are often unrecognized as such and may be mistaken for lichen planus, though this disease is rarely seen on the face. These lesions, like other types of warts, are capricious in their course but always disappear spontaneously, after months or at times years. They cause no subjective symptoms and may be associated with other warts. Their

cause is unknown, though it is probably an infectious agent.

In the treatment of flat warts, it is

FIG. 1. Acuminate warts (condylomata acuminata). They may be satisfactorily treated by electric cautery under local anesthesia.

always advisable to try internal administration of protiodide of mercury, originally suggested by C. J. White. This results in a cure of the majority of cases, at least in children, though in my experience it has not been successful in men. The drug is used in doses of ⅛ to ¼ grain, after meals. The lesions may be easily removed by a sharp curette, a method which I always use for the bearded region in men but hesitate to use in children. The roentgen rays are not successful in this type of verruca.

5. The *acuminate wart,* or so-called "venereal wart" (verruca acuminata), is also known as pointed condyloma in contradistinction to broad condyloma of syphilis. It consists of filiform excrescences which often coalesce and form large cauliflower-like growths which are more or less tufted and are constricted at the base. They occur on the sulcus or corona of the penis, or on any part of the vulva and may involve large areas including the anus, perineum, intergluteal fold and thighs. There is often a foul-smelling discharge and some soreness on motion.

Acuminate warts are auto-inoculable and extremely persistent if not treated. They occur where there is heat, moisture and irritating discharge and are seen chiefly in uncleanly persons. They were formerly thought to be due to gonorrheal infection. They are probably due to the action of various organisms though the cause is unknown. Their differentiation from broad condyloma of syphilis may sometimes be difficult. Acuminate warts are pointed with long filiform projections, whereas the condylomata of syphilis are flatter and arise from flat papules.

For the treatment of small acuminate warts, either the cautery or electrodesiccation is satisfactory. Large lesions are best removed by excision under general anesthesia. At times the lesions shrink and disappear under various applications such as permanganate of potash (1:2000) or lactic acid, 0.5 per cent. Local applications are, however, rather unsatisfactory.

6. The *senile wart* (verruca senilis), often called seborrheic wart, is a flat, scaly or warty non-pruritic lesion of varying size occurring especially on the scalp, face, trunk and back of the hands. The lesions are often multiple and may be extremely numerous, especially on the neck, back and chest. The color is some shade of yellowish brown. Senile warts occur in middle and old age and are comparatively harmless. Occasionally they may be the starting point of malignancy though less often than are flat senile keratoses of the face.

Senile warts are most easily removed by a sharp curette followed by the application of silver nitrate ·stick. They may also be satisfactorily treated by the roentgen rays, radium, electrodesiccation or other destructive methods.

MOLES

The term mole is somewhat indefinite but usually refers to a small pigmented

FIG. 2. Pigmented moles. Large lesion suitable for treatment by cautery, electrolysis or electrodesiccation. Smaller lesions best treated by cautery.

nevus which may or may not be hairy. It also includes circumscribed, soft or firm elevations, which are not hyperpigmented. My conception of moles would not include any type of vascular nevus. While a mole is known as a birthmark it is not present at birth in the majority of cases and may not appear until adult life. Moles vary greatly in size, shape and number and may be single or multiple. They may be localized or may cover large areas of the body. Like other types of birthmark they may be unilateral and at times linear. The latter type, known as nevus linearis, is a papillomatous and verrucous lesion, at times covering large areas of the body. It is not suitable to include it in this discussion.

The pigmented mole may be flat, slightly raised or may form a circumscribed and partly pedunculated elevation. The color usually varies from a light

FIG. 3. Pigmented and hairy mole, not suitable for treatment on account of large extent.

yellowish-brown to a deep brownish black. The surface may be smooth or covered by a varying thickness of hair. The combination of pigment and hair is seen chiefly in the extensive lesions and may cover as much as two thirds of the body, as in the so called "bathing trunk nevus."

The usual course of moles is to become stationary after attaining a certain size and to remain without change throughout life. They rarely cause subjective symptoms and as a rule constitute merely a cosmetic defect.

I do not believe that moles in general are a great source of danger and they should not be removed in a wholesale manner to avoid the possibility of later malignancy. There are two exceptions to this rule: When a pigmented nevus is in a situation where it is exposed to constant trauma, as on the bearded region in men, it should be removed. The same applies to a pig-

mented mole which is definitely increasing in size. In general the darkly pigmented moles, especially when covered by hair, may be safely allowed to remain. There is a type which should be radically destroyed or at least kept under careful observation. This is the bluish or slate colored, smooth mole which is not appreciably elevated. Such a lesion, if irritated by constant trauma or by improper treatment, may be the source of nevocarcinoma, one of the most rapidly fatal types of malignancy.

For the treatment of flat pigmented moles, it is proper to use electrolysis, electrodesiccation, the actual cautery or carbon dioxide snow, with or without local anesthesia. For very small pigmented nevi I have found the cryocautery of Lortat-Jacob convenient. This apparatus has various sized applicators by which the refrigeration can be confined to the desired area, whereas with a crayon of carbon dioxide snow, pressure is likely to allow the snow to spread beyond the border of the lesion. In small pigmented and hairy moles, it is advisable to remove the hairs first by electrolysis, before using one of the above-mentioned destructive methods. Large hairy moles are best treated by refrigeration or electrodesiccation. For the ordinary circumscribed elevated moles, whether pigmented or non-pigmented, I almost invariably use the electric cautery, being careful not to cause enough destruction to result in a depressed scar.

CORNS

A corn (clavus) is the familiar circumscribed lesion occurring usually on the outer aspect of the little toe, less often on the back of the second toe. It is a keratotic thickening, roughly conical in shape with the base looking outward and the apex extending inward and pressing on the nerves of the cutis. Corns are invariably painful and may become inflamed and even ulcerate. There are two types, hard and soft. The former has been described. The latter is usually situated between the toes and is soft from maceration due to heat and moisture. In association with corns, there may be a bursitis beneath or nearby, popularly known as bunion.

The treatment of an ordinary hard corn is unsatisfactory, as after removal it recurs when pressure is again applied. A time honored remedy is salicylic acid in collodion or ointment. The best treatment is prophylactic and consists in wearing properly fitting shoes and hosiery. Palliative treatment consists of soaking in hot water and soap, after which the lesion is pared and covered with adhesive strips or a protective ring-shaped pad. Soft corns may disappear when they are kept clean and dry. They should be washed frequently with alcohol and kept as dry as possible by dusting powder, such as talcum. If this procedure is not successful they may be destroyed by the cautery or by electrodesiccation.

SKIN CANCER[*]

Alfred Potter, M.D.

BROOKLYN

THE prevention and proper treatment of cancer depends principally upon education. During the last fifteen years an extensive educational campaign has been carried on against this malady and much good has been accomplished. Very little has been said, however, regarding skin cancer. Yet this form of the disease, if unrecognized and untreated, involves other organs in a large percentage of cases, and ends fatally.

It is the object of this paper to describe and set forth briefly the main points of diagnosis, and proper methods of treatment of epithelioma, which is a primary cancer of the skin. The discussion will not include other forms of cutaneous cancer which develop upon the skin secondarily from cancer situated elsewhere.

Epithelioma may be defined as an epithelial new growth with destructive tendency, originating in the epithelium of the epidermis or the glands of the skin. For practical purposes it may be divided clinically into three classes: the superficial, deep-seated, and papillomatous types. These three types differ only in their clinical manifestations.

Superficial Variety. The superficial form, sometimes known as the flat variety, is the most common. It may begin as a small, hard, brownish papule, as a wart-like excrescence developing from a wart, mole, small keratosis or greasy, scaly, seborrheic patch. The first evidence of epitheliomatous degeneration in any of the above lesions is usually an abrasion which does not heal, but gradually enlarges and becomes crusted over. After some months the degenerative changes displace the original lesion, and a deep ulceration forms which has a pearly rolled border with capillaries traversing it. The ulcer has a slight serous discharge streaked with blood. The course of superficial epithelioma is usually slow, and, while not of a very malignant nature, eventually of a very destructive; and there is a possibility in all cases of final glandular involvement or a change into the deep-seated type.

Deep-seated Variety. The deep-seated or nodular type of epithelioma may start from the superficial type or as a nodule in the subcutaneous tissue. It gradually grows larger, extending both downward and above the level of the skin. In a few months the nodule breaks down centrally, and an ulcer is formed which presents hard, everted, undermined edges, and which bleeds easily. The progress of this type is usually rapid. Muscle, cartilage and bone often eventually become involved and the neighboring lymphatic glands implicated. The internal organs may or may not have metastatic tumors.

Papillary Type. This variety usually arises from either the superficial or deep-seated type, but may begin primarily as a warty growth. When fully developed, no matter how it originated, the growth presents an ulcerated, fissured, papillomatous surface with a slightly inflammatory infiltrated base. Papillary epithelioma also develops a malignant tendency resulting in deep infiltration, involvement of the glands, and ending fatally.

CAUSE

While the cause of cancer is still undetermined, there are many contributing factors which should be borne in mind. As in other forms of the disease the tendency of epithelioma increases with age. Most epitheliomata occur after the age of forty, although cases in the young are by no means unique.

Local irritation is an important etiological factor. An irritated wart or mole, or a neglected seborrheic patch, or keratosis is often the starting point.

Cancer of the lips, tongue and floor of the mouth is almost invariably preceded for some time by an unhygienic condition of the mouth and teeth, seen frequently in educated persons of otherwise cleanly habits.

The development of epithelioma upon other lesions of the skin is not uncommon, not only upon keratoses and leucoplakia, but also upon chronic varicose ulcers of the leg, or in the scars of lupus and syphilis. The occurrence of cancer in those exposed continually to the sun's rays has been often mentioned, and should probably be emphasized at this time when all forms of sunlight treatments are so popular.

DIAGNOSIS

The diagnosis as a rule is not difficult. The most characteristic features to be recognized are the hard, nodular, waxy border, infiltrated base, and the free bleeding of the lesions. Epitheliomata are generally single, in contradistinction to the lesions of lupus vulgaris and tubercular syphilis. The most frequent location of cutaneous cancer is on the lower lip, side of the nose, the cheek near the inner canthus, the buccal mucous membrane and the tongue. They may occur, however, on the backs of the hands, on the penis, in the vagina, or in fact any part of the body.

Lupus vulgaris generally occurs in the young, and the soft brown apple-jelly lesions would easily distinguish it from epithelioma.

A chancre sometimes looks quite like an epithelioma. The history, rapid appearance of the lesion, the finding of the spirocheta, and the subsequent appearance of the secondary manifestations and positive Wassermann reaction should easily settle the diagnosis.

Tertiary lesions are differentiated by their multiple lesions, serpiginous outline, and characteristic atrophic scars.

One other condition which is likely to be mistaken for epithelioma is pyogenic granuloma.

TREATMENT

The only correct treatment of epithelioma is complete destruction. Preliminary treatment with salves, pastes, or mild caustics only stimulates the growth of the lesion and lessens the chance of ultimate recovery.

The radical treatment of epithelioma may be carried out by currettage, followed by the application of caustics, the endotherm knife, exposure to the roentgen rays or radium, or by surgical excision.

Upon the surface of the skin, in my experience, the best method of treatment is by thorough currettage followed after all bleeding has been stopped by the application of acid nitrate of mercury for from five to twenty minutes, depending upon the extent and depth of the lesion. The acid is finally neutralized by bicarbonate of soda in powder form. This method is much surer to remove all outlying cancer cells, sacrifices less healthy tissue, and gives a much better cosmetic result than excision. Furthermore, there is less likelihood of reimplantation of cancer cells than by excision. While other caustics may be used with equally good results, I have found the acid nitrate of mercury the most satisfactory. I believe the method just described, except in certain selected cases, cures epithelioma more quickly and more satisfactorily than either roentgen rays or radium, although both these methods of treatment give excellent results in expert hands.

The endotherm knife is a method which has been used in more recent years, and possesses the advantages of the operation by currettage and caustic application. It will probably be much more widely used in the future.

In deep-seated epithelioma of the lip,

however, with involvement of the contiguous lymphatic glands, or in epithelioma of the mucous membrane, tongue, or floor of the mouth with glandular involvement, surgical excision of the epithelioma, preferably with the endotherm knife, with block dissection of the regional lymphatic glands, supplemented by the roentgen ray, is the only method that is justifiable.

SUMMARY

Epitheliomata are among the frequent and most important lesions of the skin.

Epithelioma in the beginning is a local condition and if thoroughly removed is curable in 100 per cent of the cases.

Skin defects such as moles, warts, scaly or crusted patches, and wounds which do not heal promptly, should be regarded with suspicion and treated promptly and thoroughly, especially if located in places subject to irritation.

Many such lesions, although they show no clinical evidence of degeneration, when removed prove to be cancerous under the microscope.

In all forms of epithelioma a certain amount of deceptive healing may occur. Superficial lesions may heal over completely and in the deeper forms even enough connective tissue may be formed to produce scars, but in such healings nodules of epithelioma are always left and sooner or later the disease recurs.

FISSURE OF THE ANUS
& THROMBOTIC HEMORRHOIDS*

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FISSURE OF THE ANUS

A SIMPLE fissure is a longitudinal rent in the mucocutaneous lining of the anal canal, characterized by intense pain during and especially after the act of defecation. As fissure constitutes about 8 per cent of rectal diseases, its prompt recognition and proper management are of importance. Fissure commonly occurs in adults, more frequently in children than is recognized, but only seldom in the aged when the anal sphincters tend to relax. The lesion may be situated at any point in the anal ring, but in a typical case it is single and situated in the posterior commissure. In men about 1 per cent of fissures are in the anterior commissure and in women about 8 per cent are at this point. Exceptionally women especially have an anterior and a posterior fissure.

The immediate exciting cause is usually trauma, commonly by the passage of a hard scybalum, the clumsy use of a syringe tip, unskilled prostatic massage, and frequently it follows parturition.

In its acute early stage a fissure is usually superficial, but it may extend through the mucosa to the sphincter muscle. Unless an acute fissure is relieved, local infection tends to produce a fibrous induration of its margins which may become undermined, resulting in the so-called irritable ulcer. Consequent to the local infection, a skin tab frequently develops at the outer end of a chronic fissure. Although not hemorrhoidal, this is known as the "sentinel pile" of Brodie and, when present, is a sure indication of fissure. The highly sensitive nerve terminals involved in the fissure are irritated, resulting in spasm of the sphincter muscles which, together with the fear of pain at stool, induce or increase constipation, and lead to stasis toxemia. Extension of infection through the base of a fissure is a common cause of abscess and consequent fistula.

The cardinal symptom is exquisite pain, beginning usually with the passage of a stool and lasting from a few minutes to several hours thereafter as a dull ache or throbbing. The stool may be blood-streaked and accompanied by a few drops of fresh blood. Because of the close association of the nerves supplying the anal canal and the urogenital organs, reflex symptoms of dysmenorrhea, dysuria or vesical retention may be misleading. Likewise, pains referred to the iliolumbar and sciatic nerves may lead to the erroneous diagnosis of lumbago or sciatica.

The typical history usually furnishes the correct diagnosis. Nevertheless, a local examination should always be made. Its successful accomplishment is a tribute to the gentleness and skill of the examiner. With the patient in the Sims' position the buttocks are retracted. A "sentinel pile" is an almost infallible sign of a fissure situated immediately above it. A fissure or at least its lower margin can usually be seen between the radiating folds, but it may be obscured by hemorrhoids or edema of the mucosa. Local tenderness and sphincter spasm may bar digital examination unless sensation is dulled by the application of anesthesin to the fissure or the injection of 1 per cent novocaine solution beneath it. Full exposure of the lesion is best obtained by the introduction of a Brinkerhoff or similar

speculum, placing the slide toward the fissure. If an abscess complicates the fissure, digital and instrumental examinations should be deferred until the administration of an anesthetic preliminary to the necessary surgery.

In the treatment of fissure the error is frequently made of constipating the bowels. Regular daily action should be obtained by a generous mixed but bland diet. One-half ounce of liquid petrolatum is taken night and morning and a retention olive-oil enema of 4 oz. is administered through a soft rubber catheter on retiring to soften the first portion of the stool. After defecation the patient should take a hot sitz bath of normal saline solution for ten minutes and rest until the pain has subsided. An acute fissure, seen within one to three days of its occurrence, may be cured frequently by the application every other day of pure ichthyol on a glass rod or 3 per cent silver nitrate in spiritus aetheris nitrosi.

In 1924 and again in 1926, A. B. Graham reported the successful use of quinine and urea hydrochloride in 77 per cent of 128 cases of fissure. I have found it equally satisfactory in many cases, especially in the acute stage. The technique is simple and readily carried out in the office. A *freshly prepared* 5 per cent aqueous solution of the drug is injected just beneath the fissure. The needle punctures the skin just below the lower margin of the fissure and as it is slowly advanced a total of 1 c.c. of the solution is deposited. The drug produces a fibrinous exudate which isolates the fissure, and anesthesia which is prolonged over several days. Unless a single injection is effective, the treatment may be repeated.

Benacol solution injected in the same way, we have found to be equally efficient. As a sentinel pile, if present, prevents drainage and so healing of the fissure, it should be novocainized and ablated.

Another simple office measure, sometimes curative, is to anesthetize the parts and then to pass a small needle-pointed

cautery or the endotherm knife through the entire bed of the fissure.

Divulsion of the sphincters will usually cure a fissure, but in the chronic indurated variety the lesion should be excised at the same time. Anesthesia is by ether to the point of surgical narcosis, or by transsacral block with novocaine. Mechanical dilators are no substitute for the fingers which gradually stretch the muscles in five to ten minutes until the orifice remains patulous. Sphincter tone is regained in two or three days.

Incision is the most satisfactory method of treating a chronic fissure and always results in a cure. After the parts are infiltrated with 1 per cent novocaine solution, the buttocks are retracted and an incision is made through the bed of the fissure and out through the skin 3 or more centimeters. The external sphincter is divided superficially at a right angle to its fibers until the finger slips easily into the rectum. The margins of mucosa bordering the fissure are excised and the incision is packed with superimposed layers of vaseline gauze. The bowels are moved on the third postoperative day by an oil enema which releases the packing. The wound is cleansed after every stool with hot water or a sitz bath and is dressed every third or fourth day until healing is complete, which should be in about two weeks.

THROMBOTIC HEMORRHOIDS

Thrombotic external hemorrhoids are caused by a strain or traumatism of the engorged external hemorrhoidal veins, such as effort at stool, violent physical exercise and coughing or sneezing. Rarely the vein is thrombosed, but as a rule all coats of the vessel are ruptured and the blood accumulates in the connective tissue as a single large clot or several small clots beneath the tense shiny skin at the anal verge. The patient experiences a sense of local swelling and discomfort which very soon becomes a severe constant pain, often throbbing in character, and aggravated by pressure or defecation. A tight spasmodic sphincter

ani aggravates the pain which is due to the pressure of the clot on the numerous sensory nerve endings in the perianal skin.

sitz baths and wet compresses of lead and opium wash, magnesium sulphate or boric acid solution may result in resolution of
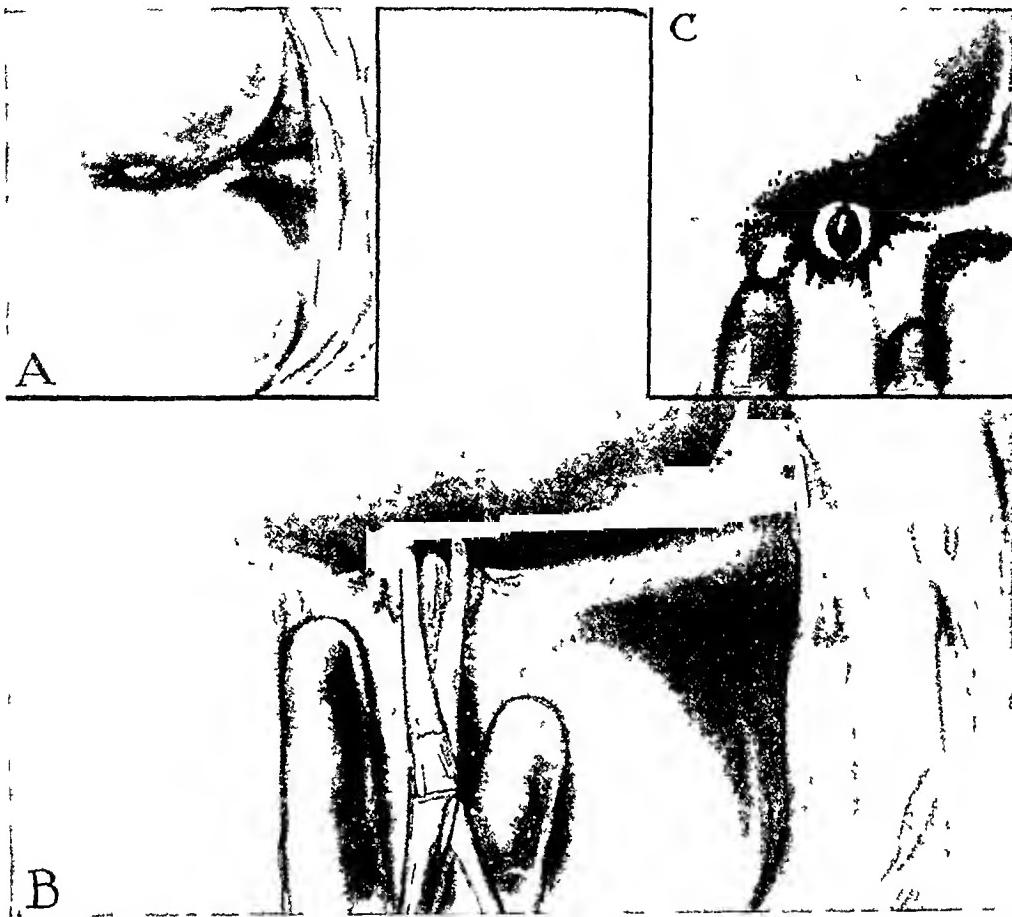
FIG. I. A, Thrombotic external hemorrhoid B, Method of excising an ellipse of overlying skin by single clip of scissors curved on flat. C, Clot protruding through incision. (From Yeomans' "Proctology," D Appleton & Co)

Unless obscured by edema, inspection reveals an ovoid, bluish swelling, the size of a grape or smaller, which to palpation is firm and tender.

A small clot may undergo resolution in about ten days, but usually a shot-like induration persists or, as a result of irritation, an annoying skin tab forms. If the clot is larger, and especially when it extends upward beneath the anal lining, pressure necrosis frequently ensues, followed by bleeding and retention or expulsion of the clot. Infection may occur, resulting in an ulcer or superficial fistula.

Treatment. Ointments and suppositories are useless palliative measures, but hot

small clots. Because of the prolonged treatment necessary, the avoidable suffering and uncertain outcome, palliative measures are a poor substitute for a minor operation which gives prompt relief.

After applying tincture of iodine, the skin over the tumor is infiltrated with 2 per cent novocaine solution. Then, with a sharp, slender scissors curved on the flat, an ellipse of skin is excised by a single cut, extending from the outer to the inner margin of the thrombus. Usually the clot delivers itself spontaneously, but, when retained, the scissors are insinuated, snipping the surrounding connective tissue as necessary until it is freed and evacuated

intact. Nothing other than the sterile scissors enters the wound. The margins of the incision close in accurate apposition and a sterile compress applied firmly to the wound for a few minutes controls the slight bleeding. A small compress is then retained firmly in place over the wound by a strip of adhesive tape 15 in. long and 1 in. broad, running from the inner side of the thigh, close to the anus and upward over the buttock to the loin. The operation is painless, but local smarting or burning may last an hour or two after the anesthetic wears off. The dressing is removed after twenty-four hours and the wound is sponged with hot water on absorbent cotton after each stool. No further bandaging is required, but the wound is protected by a small pledget of absorbent cotton dusted with aristol. Primary healing of the wound usually follows this technique and in a week the scar is barely visible. Detention from business rarely exceeds one day.

When the tissues are infiltrated with numerous small clots, it is good practice to ablate the entire mass and to treat the site of removal as an open wound.

Thrombotic Internal Hemorrhoids. Occasionally circumscribed thromboses occur in the venous radicles of the superior hemorrhoidal vein, under the same conditions as produce clotting in varicose veins in other situations. At other times, fecal or other trauma may cause the diseased veins to rupture, the extravasated blood forming a more or less extensive clot in the submucosa. The patient experiences a sense of fullness, weight and sometimes throbbing in the lower rectum.

Digital examination detects, just within the rectum, an irregular, tender, boggy swelling. This may suggest an abscess, but in thrombosis the onset is usually more abrupt, tenderness is less marked, and elevation of temperature and leucocytosis are absent. This differentiation is very important therapeutically. Abscess requires immediate operation, whereas thrombosis usually subsides in a few days under rest in bed and antiphlogistic measures, among the best of which are rectal instillations of warm olive oil.

If pressure necrosis of the overlying mucosa and infection occur, treatment is the same as for abscess in this situation.

ADHESIVE PLASTER STRAPPING*

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ADHESIVE plaster strapping may be advantageously used for many disabilities occurring in ambulatory patients. Its employment should be restricted to those cases in which a short period of treatment, usually not more than two weeks, may be expected to achieve a result. Longer periods of continuous strapping are usually not well tolerated by reason of skin irritation, although skin tolerance varies considerably.

TECHNIQUE

Zinc oxide adhesive plaster rolled on 1 and 2 inch spools answers practically all purposes. Plaster with a flimsy "body" is unsatisfactory. The part should be shaved dry. The strips should be evenly applied, all wrinkles being smoothed out with the thumbs as the strips are applied. In this manner a smoothly fitting dressing may be applied around bony prominences and other irregularities of contour.

USES

The primary purpose of an adhesive plaster dressing is that of ambulatory splintage of a more or less efficient sort, depending upon circumstances. The desirability of such splintage may arise from the following therapeutic indications:

1. To restrain activity.
2. To support a temporarily weakened part.
3. To exert pressure.
4. To "sling" a muscle.

These indications nearly always overlap, but usually one of them determines the precise nature of the dressing to be applied.

SOME COMMON CLINICAL TYPES

Foot Strain, "Flat Foot."—This is the commonest disability encountered in urban societies. These patients seek immediate relief and no matter what ultimate therapeutic measures may be contemplated, such relief can be afforded them by strapping.

The patient is to hold the foot dorsal flexed, moderately inverted, and with the toes flexed. In this attitude the tendon of the tibialis anticus stands out prominently. The strapping is applied as illustrated in Figure 1, thus supporting the long arch by an adhesive plaster sling whose point of fixation is the skin of the inner side of the leg.

Anterior Metatarsalgia, Morton's Toe.—When the symptoms are limited to the front part of the foot, as they more often are in women, the anterior arch may be supported by a felt pad placed just behind the metatarsal heads. The toes should be flexed, and the encircling straps should mildly compress the front part of the foot (Fig. 2.)

Strain of the Tendo Achilles Insertion, Achillobursitis. This exceedingly troublesome and disabling condition can nearly always be relieved by a period of strapping. The object is to restrain the activity of the calf muscle. It is important therefore that the strapping be applied with the foot in plantar flexion. The strapping is begun at the middle of the foot and is carried to a point above the belly of the calf muscle (Fig. 3.) The heel of the shoe is to be raised $\frac{1}{4}$ to $\frac{1}{2}$ inch during the period of treatment.

Sprains and Minor Fractures about the Ankle.—Certain cases of malleolar fracture in which there is little or no tendency to displacement of the fragments can be made ambulatory after the first few days. After the initial swelling has somewhat subsided, a strapping may be applied.

FIG. 1. Dressing for flat foot.

FIG. 2. Dressing for metatarsalgia.

FIG. 3. Dressing for achillobursitis.
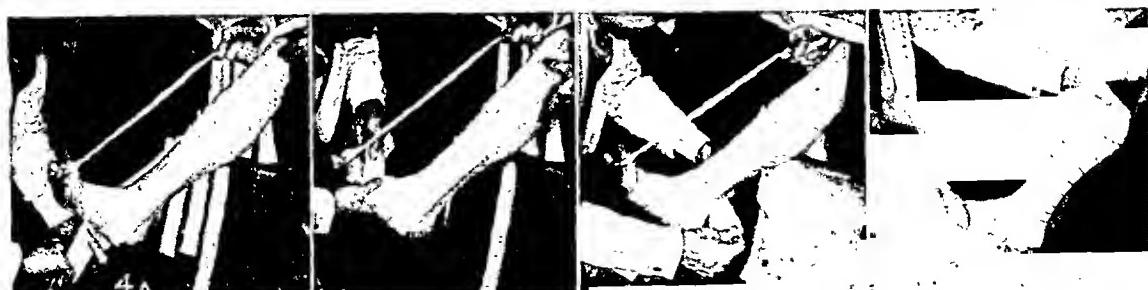
FIG. 4. Dressing for sprains and minor fractures about the ankle.

The foot should be held in the attitude described for the strapping of a flat foot, but the strapping should be somewhat more extensive, as shown in Figure 4.

Strain of the Knee Joint, Acute Traumatic Synovitis.—With the knee held in extension, alternately crossing strips are applied from well below the tibial tubercle

FIG. 5. Dressing for knee joint.

FIG. 6. Strapping for strain of lower back.

to the upper third of the thigh. The strapping should not entirely encircle the limb, about one quarter of its circumference being left free posteriorly (Fig. 5).

Strain of the Lower Back.—In order to be effective, the strapping should entirely encircle the lower part of the trunk. It is unsatisfactory in obese patients. The patient stands with the abdomen retracted; the surgeon is seated behind the patient. Three 2 inch strips are applied anteriorly, the lower limit of the dressing extending practically to the level of the trochanters. The posterior strips are then applied. These should extend well forward of the anterior superior spine on both sides, and they should be applied under some tension, as though the effect to be obtained were a compression of the sides of the pelvis.

EXPLORATORY THORACENTESIS[*]

A BRIEF OUTLINE OF THE INDICATIONS AND THE TECHNIQUE OF ITS APPLICATION

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THE proper technique of exploratory thoracentesis or therapeutic aspiration is universally too little understood and much too frequently carelessly performed. In many of its applications there is little thought given to the essentials necessary or to the complications that may result from lack of knowledge of this very important diagnostic or therapeutic measure.

When contemplating thoracentesis there are several fundamental principles to be adhered to: protection of the patient, selection of proper instruments and avoidance of complications.

Exploratory thoracentesis is performed for the purpose of determining the presence or location of a pleural effusion and its character, and is most often applied during metapneumonic or postpneumonic infections as an aid in the diagnosis of empyema.

If observed as a preoperative precaution in operations for empyema such errors as thoracotomy or costectomy upon patients with massive pneumonia, where percussion dullness is evident from apex to base, and operation upon the well side of an empyema patient, would be avoided. Such errors are known to have occurred.

TECHNIQUE

If possible have a roentgenogram taken of the thorax. Examine the chest carefully for signs and location of fluid and determine as accurately as possible the point of maximum dullness. Observe strict surgical asepsis in preparing the skin of the patient from the sternum to the spine and from the clavicle to the costal arch, employing 3 per cent tincture of iodine followed by alcohol. Drape the field with a sufficient number of sterile towels and sheets. A sterile gown and gloves should be worn by the operator. Needles, syringes and solution for local anesthesia should be thoroughly sterilized.

These preliminary steps will minimize the danger of carrying infection from without into the pleural space and accidentally producing empyema where none existed previously.

The next step is to anesthetize carefully the point of election with sterile 1 per cent novocaine solution, beginning in the skin by producing a wheal with a fine hypodermic needle and carrying the anesthesia slowly down to and including the parietal pleura, changing to a longer fine needle if necessary and always forcing the anesthetic ahead of the needle as the point advances.

Select an aspirating needle 4 cm. in length, of about No. 20 gauge and first pass the point through the skin. Then attach the needle to a 20 or 30 c.c. Luer syringe, *with the piston pushed all the way in.*

With the left hand resting on the chest and the thumb and index finger grasping the shoulder of the needle, the needle is slowly forced through the thoracic wall under guidance and control of the left thumb and finger and as it passes between the ribs, traction is made on the piston with the fingers of the right hand so that when the point of the needle enters the pleural space, fluid if present will immediately flow into the syringe.

The probable thickness of the thoracic wall should be estimated and if fluid is not found the needle should not be passed so

deeply that it will enter the lung. If the lung is infected there is danger on withdrawing the needle of contaminating the pleural space and producing empyema. This is especially true where lung abscess exists. Where pneumothorax is already present as determined by physical signs or roentgenographic examination, the needle may slowly be passed deeper into the pleural cavity until the level of fluid is reached.

THERAPEUTIC ASPIRATION

If during thoracentesis it is desirable to remove a quantity of fluid, a Potain set may be employed, or an aspirating needle may be connected to the syringe by a piece of rubber tubing several inches long and fitted with suitable adaptors; and when the syringe is disconnected for emptying, *the tube should be clamped* to prevent air from passing into the pleural space and producing a pneumothorax.

If an adaptor is not at hand and it is necessary that fluid be removed at that time, the needle may be partly withdrawn until the point rests in the tissues of the thoracic wall each time the syringe is disconnected for emptying.

When pneumothorax follows exploratory or therapeutic thoracentesis, all physical signs are modified.

PLEURAL REFLEX

It has been reported that on rare occasions syncope or death has followed exploratory thoracentesis, especially of a healthy pleural space where no effusion was found. This is believed by some to result from shock produced by puncture. The more rational belief, however, is that it is due to an air embolus and may be caused by either of two ways: one, by communication established between a bronchus and a blood vessel brought about through injury by an aspirating needle; the other, by air passing through a deeply inserted aspirating needle into a blood vessel in the lung, either through an open needle or by air being forced in by a syringe from which the piston has been partly withdrawn.

While this may be only theoretical it is best to observe every precaution. For this reason, it is very important to see that the piston always reaches to the bottom of the aspirating syringe before being connected to the needle, the point of which has first been permitted to pass through the skin only. When fluid is present, the lung is forced away from the parietal pleura and a carefully inserted needle does not pass through the visceral pleura.

STRANGULATED HERNIA*

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THE strangulation of any hernia converts a condition compatible with life, if not comfort, into one fraught with peril. This transition, depending on many factors, is rapid, stormy. It demands prompt recognition, sensible treatment.

The common varieties as seen in routine hospital practice are inguinal, femoral, umbilical and incisional, the last presenting an increasing incidence because of the greater number of abdominal operations. Without attempting a statistical study, not germane to the purposes of this article, the writer's impression is that strangulation of the umbilical, incisional and femoral hernias is more often encountered than inguinal. This is perhaps due to the fact that the first three occur mostly in women whose household and family duties keep them so busily engaged that they cannot spare time for operation. The inguinal hernia is the man's hernia. Interfering with his capacity for work, or, indeed, to get work, he seeks operative relief more promptly, decreasing the total number of inguinal hernias about and incidentally the percentage of strangulation.

As in managing any ailment to which the human machine is susceptible, the first step is to diagnose it. In the first instance a clear understanding of what constitutes strangulation is necessary. Curiously, there is often lack of that understanding. Hernias may be irreducible, incarcerated or strangulated. An irreducible hernia is self-explanatory. If its content be bowel and the fecal current is shut off, then it is incarcerated. If, in addition, its blood supply be cut off, it is strangulated. Hernias may also be inflamed. That is, the usual signs of inflammation are present in the skin overlying a hernia. Such hernias are often mistakenly regarded as strangulated.

Symptomatology when strangulation occurs is variable, but there are two outstanding symptoms consistently present. One is pain and the other is that somewhere on the facade of the body appears a lump which cannot be pushed back into the belly; or that a lump which previously could thus and there be pushed, now becomes recalcitrant. The pain is severe, prostrating. Generalized at first, it soon localizes in the hernial vicinity and continues until the hernia is reduced or the contents become gangrenous, when it diminishes in degree only.

Vomiting is variable, but practically always present. Its character and severity depend on what is caught in the sac. If it happens to be small intestine, the vomiting is prompt. The higher up the intestinal pathway, the more prompt and severe is the vomiting. On the other hand, if the content is omentum, vomiting does not ensue so rapidly or so severely. The vomitus is gastric, duodenal and intestinal successively, as the gut, cephalad to the strangulation, struggles to relieve itself of its imprisoned contents.

Obstipation supervenes at once, although a bowel movement often occurs shortly after the strangulation occurs, representing expulsion of fecal material in the lower bowel. If the hernial content is omentum, bowel movements may occur. Flatus, obviously, concurs with the solid matter.

Temperature and pulse show but little elevation at the inception of the attack.

Careful examination of the hernia is most helpful in arriving at a determination as to the existence or non-existence of strangulation. *En passant*, it is well always to remember that in the aged small femoral hernias may exist without attracting the patient's attention and when strangulated may be very easily

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overlooked by the physician unless the femoral regions are carefully palpated. In all patients suffering from abdominal cramps and vomiting the possibility of strangulated femoral hernia must ever be kept in mind.

In examining a given hernia the immutable rules should be followed: look, feel, percuss, listen. The senses involved in the combination yield much valuable information.

Inspection defines location, size, shape, presence or not of inflammatory signs in the skin, be they resultant on what has gone on inside the sac or on outside influence such as a truss, intertrigo, or too zealous use of heat; visible peristalsis, an observation of value in determining whether strangulation exists or not. If present, the gut is probably not strangulated.

Palpation yields much that is important. Our tactile sense informs us as to the tension of the hernial mass, always marked in strangulation, its reducibility, non-existent if strangulated, as is a cough impulse. It also conveys the consistency of the mass: hard, "doughy," if omentum is caught; softer, more fluctuant, if it is bowel; frankly fluctuating in late cases when either pus or fecal matter is free in the sac, following gangrene and perforation. The degree of tenderness is noteworthy, always more pronounced in strangulation than incarceration. Careful palpation helps to estimate the extent of the extruded viscera, absolutely and in relation to the peritoneal opening. In the ventral cases, i.e., umbilical and incisional, the hernial content may be extensive yet present a relatively small peritoneal opening. Such hernias "mushroom" under the skin, usually contain omentum, and if strangulation occurs it is due to a knuckle of bowel caught at the ring. The smaller the ring the greater the danger of strangulation. A strangulated femoral hernia with not more than 2 in. of imprisoned small intestine is generally more serious than a huge ventral hernia. Palpation will often aid in differentiating between acute intestinal obstruction within a hernial sac and within the abdomen at or near the neck. This is not an infrequent occurrence and is especially noted in the very large inguinal and incisional hernias.

Percussion is useful in arriving at a conclusion as to whether bowel is in the sac or not. If the note is tympanitic, there is bowel; absence of a tympanitic note does not exclude the presence of bowel, as overlying omentum will conceal intestine.

Auscultation is an important aid in determining if strangulation has involved the intestinal tract. Exaggerated peristaltic sounds may be heard on careful listening with the stethoscope and may often be followed down to the hernial sac, where they abruptly cease.

Having thus utilized some of the special senses and having arrived at the conclusion that the hernia is strangulated, what next?

Naturally, one's first thoughts are conservative and efforts are directed to effect reduction by taxis. To this end the foot of the bed is raised, the hip and knee joints are flexed, and *careful, gentle* pressure is made in such a way as to return the escaped viscus to its home. The patient from long experience may often accomplish this maneuver much more expeditiously than the doctor. He derives double satisfaction in that he has relief and has put one over on the doctor. Internal rotation of the flexed thigh is often helpful in reducing an inguinal hernia. Local application of heat is frequently useful. Infiltration locally, with ½ per cent procaine may be of service in facilitating reduction. A hypodermic of morphine is useful. These methods apply only to the patients seen early. Strangulation existing over a period of hours is best managed by open operation, the sooner the better. No patient dies from being operated on too soon.

At operation, two major problems present. The first is to save life, the second is to cure the hernia. Both may be difficult, depending on the findings.

In the pre-operative management too

great emphasis cannot be laid on the necessity for emptying the stomach. Between intake, unless peremptorily shut off by the doctor, and the back-spill from the bowel, the gastric viscus becomes a cesspool. Siphonage saves lives. A mistaken sense of consideration because of the discomfort engendered by a stomach tube often prevents its use. It is far more essential than the rectal tube, which is so industriously and, as a rule, ineffectively applied.

Choice of anesthetic has an important influence on the result. Most strangulated hernias may be successfully managed under local anesthesia, using procaine by infiltration, or field-block. Spinal anesthesia has a field of usefulness as has nitrous oxide-ethylene among inhalation anesthetics.

The operative procedure is, of necessity, determined by the condition found. The hernial sac should be exposed, freed, opened, and the site of strangulation uncovered and dealt with as needed. If incision is necessary it is well to keep in mind in inguinal hernias the location of the deep epigastric vessels, and cut up and out; and in femoral hernias to confine one's efforts with the scalpel to the mesial aspect of the femoral canal, and divide Gimbernat's ligament.

Further steps take one to the sac content. Gangrenous omentum is to be ligated and excised. If the content be bowel careful scrutiny of it and its mesentery is necessary to estimate the local damage. What is the color of the gut, is the serosa intact, is there visible peristalsis, is there evidence of thrombosis of the mesenteric vessels? Their presence, or absence, respectively, together with the general condition, constitute the basis on which decision to resect, or not, will rest. This decision is difficult and has great bearing on the mortality. Generally speaking, resection is to be avoided if possible. If found necessary, it should be done most rapidly and the bowel proximal to the obstruction emptied by suction and drained by means of a rubber tube implanted by the so-called

Witzel method. The tube brought through the operative wound, or a stab wound, is to be connected with a bottle. It serves as a vent for gas and for retained fecal matter of high toxicity.

Having completed whatever work is needed within the sac, it is to be ligated, divided, excised and plastic repair of the abdominal wall effected. In incisional and umbilical hernias imbrication is the standard method; in the inguinal group, fascial repair, i.e., the suture of homologous structures, is the ideal to be sought; in those arising in the femoral canal, obliteration of the femoral opening by suture of the ligaments of Poupart and Gimbernat and of pectineus fascia is usually sufficient.

If operative procedure has been prolonged or extensive or there has been much tissue trauma, it is wise to drain the wound.

Postoperative management may be simple or may call for close watching and active treatment. Those patients who have been operated on promptly without the necessity of bowel resection offer no greater problem as a rule than uncomplicated hernioplastys. On the other hand, patients operated on late, who have had resection, are likely to have a stormy course. Their needs are best met by frequent use of the stomach tube, preferably siphonage, i.e., emptying without lavage; morphine for pain or restlessness; water salt and sugar. Water by mouth; salt solution 0.9 to 3 per cent subdermally, intravenously, per rectum, and 10 per cent glucose intravenously meet the physiological requirements.

The very late cases with signs of frank intestinal obstruction are best managed by jejunostomy, or ileostomy, under procaine anesthesia, combined with the measures mentioned above which are designed to eliminate toxic gastric accumulations, to restore the diminished blood chlorides by salt solution and to furnish nutriment with glucose. If they can be tided over until the general condition improves direct attack on the hernia can be initiated with much greater assurance of success.

LOCAL SURGICAL TREATMENT OF
INFECTIONS OF THE FACE[*]

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DURING the past few years articles have been published calling attention to the possible fatal outcome of acute infections of the face. While this may be true of infection starting in any portion of the body, the rapidity with which an apparently simple local infection can become a severe or even fatal infection, has been described as a peculiarity of facial infections. This is graphically brought out by a quotation from one of these writers: "A friend had a pimple in the nose. On Saturday morning he went to see a well known specialist who opened the pimple. On the following Tuesday morning he died." It is hard to believe that so rapid a fatal outcome could have followed if the pimple had been on the arm or chest or any part of the body other than the face.

The explanation must lie in some difference in the anatomy of the face, and particularly in the center of the face, which may favor the spread of an infection into the deeper parts. The intimate attachment of the muscles to the skin, and the consequent absence of a well-marked subcutaneous layer of fat, with a layer of fascia beneath it, is mentioned as a possible cause. Other writers have blamed the richness of the veins in this locality and the fact that they have no valves; though how valves could hinder the spread of infected blood *toward* the center of the body, it is not easy to imagine. Another suggested cause is the absence of lymph glands in this vicinity. One should also keep in mind the numerous pre-formed serous spaces in the bones of the face and skull; and their accessibility to an extending inflammation; for the usual spread of infection is first by the lymph channels, and later, possibly, by the blood.

Whatever the pathology may be we must accept the fact that a patient with a facial infection is in some danger of deeper, and possibly fatal, infection. This risk, expressed in percentage of deaths to all cases of facial infection, must be a very small one; far smaller than a surgeon operating chiefly upon ward patients would *be likely to realize; but none the less it is a* real risk, and should be reckoned with. It is therefore important to consider what bearing this risk has on the treatment of a patient with a *commencing* purulent infection of the face.

By limiting the consideration to *commencing* infections we shall keep well within the limits of minor surgery. This also permits one to observe accurately the type of infection, and its method of spreading or disappearing, while the patient is essentially normal, and not overwhelmed by the poisons of an extensive or deep-seated process; nor by any of the complications which may follow prolonged infection. Moreover the effect of local treatment can best be judged, while the infection is in its early stage, and still well localized.

For practical purposes these commencing infections may be divided into three groups according to the depth of penetration of the infective agent. In the most superficial type, the pus when formed lies just under the epithelium. It may dry up or be expelled, with or without treatment, the lesion never having become anything more than a very small pimple; or it may extend into the deeper skin or below it.

The second group is made up of small boils and some mild carbuncles, situated in the true skin, which either spontan-

eously or because of favorable treatment discharge their pus and necrotic tissue, if any, externally, before the inflammation has been able to extend materially beneath the skin.

In the third group such extension takes place, but only in tissues in immediate contact with the primary lesion. If the infection has spread to the deeper parts, and has produced thrombosis or abscesses in the sinuses or elsewhere it is no longer in the early stage to which this paper is limited.

The conclusions of the writers of some of the articles referred to were so at variance with my own experience that I decided to make notes of the facial infections that I was called upon to treat. It so happened that the next 6 patients in this category illustrated the three different depths of infection mentioned above. They were in brief as follows:

CASE I. B. R., male, aged thirty-three years. Four days previous to examination was shaved in a "dirty shop." Two days previous to examination noticed a pimple of the lower lip which he did not squeeze. One day previous to examination the lower lip began to swell and the swelling increased rapidly.

At examination: A pus scab ¼ in. in diameter just under the epithelium of the lower lip, to the left of the median line. Marked edema of the lower lip, especially of the left two-thirds. No *hard* swelling; little pain; temperature 98.4° F.

Treatment: Scab picked off; ulcer swabbed with a chlorine solution and a simple ointment applied. Patient to apply moist heat every fourth hour.

Twelve hours later swelling two-thirds gone. One day after treatment swelling entirely gone; ulcer shallow.

CASE II. H. F., female, aged nineteen years. A four days' pimple of the upper lip; not squeezed. One day before examination a "yellow head" was picked off and hot water applied.

At examination: Small opening in skin filled with a friable slough and a minute drop of pus; induration ⅜ in. in diameter.

Treatment: Slough picked out with slender forceps; dry dressing.

One day later; induration ⅛ in. in diameter; dry scab. This removed for examination of wound; no pus under it.

CASE III. M. M., female, aged sixty-four years. Five days previously a pimple of the right cheek, just above lip, was picked and squeezed. No subsequent discharge.

At examination: Small mark in skin; no pus showing; induration ½ in. in diameter.

Treatment: Injection of ¹⁄₂₀ grain of cocaine; incision, ⅛ in. in diameter, made crucial beneath the skin. Small amount of pus escaped; dry dressing. Hot water to be applied t. i. d. by patient.

One day later; induration ⅜ in. in diameter and softer; slight discharge.

Two days after operation induration less; redness less; discharge less.

Six days after operation induration gone; redness gone; small dry scab.

CASE IV. J. V., male, aged twenty-four years. Two days' infection of right cheek near nose.

At examination: Small pustule midway between right nostril and pupil of right eye; deep induration ⅛ in. in diameter; edema from edge of eyelid to lower part of nose.

Treatment: Minute cocaine injection; deep puncture with narrow-bladed knife; small amount of pus and serum escaped.

Two days later; swelling gone; dry scab in wound; this removed for examination; no pus under it.

CASE V. W. T., male, aged twenty-seven years. Two days' small hard boil on right cheek; pricked and squeezed by patient.

At examination: Deep conical induration, ¾ in. in diameter, surmounted by a blister.

Treatment: Blister clipped off; small cocaine injection; small deep incision ⅜ in. long; a few drops of pus escaped. Daily dressing.

After three days induration nearly gone; a small slough of skin, exactly bisected by the incision, now loosening. The infection showed no tendency to spread after the incision.

CASE VI. H. K., male, aged sixty years. Seven days' small carbuncle behind left ear but not in the hairy scalp. Slight discharge through two small openings; no manipulation by patient.

At examination: Raised reddened area, ¾ × 1 in.; several visible points of suppuration, two of which are discharging. Edge of

infected area sharply limited; no surrounding cellulitis.

Treatment: 4 pus pockets opened by very small crucial incisions. Dressed with simple ointment on dry gauze.

Two days later part of slough picked out.

Four days after operation remainder of slough loose and picked out. Only a small loss of skin; same dressing.

Five days after operation no more pus or slough; opening in skin ⅛ in. in diameter.

Ten days after operation wound entirely healed.

What conclusions may fairly be drawn from these cases? In the first place let it be freely admitted that the spread of an infection depends not only on its situation and extent, but also on the nature of the infective organism, and on the resistant power or the patient. Probably the infection in all these cases was of a mild type; and all the patients were apparently healthy, so that their resistance was probably high. Moreover it is quite likely that the patients would have recovered if other types of treatment had been employed; or without any treatment whatever. In Case II recovery, as far as the spread of the infection is concerned, had already taken place, so that no active treatment was given. In Cases IV and V, if one had waited for a spontaneous cure of the infection to take place, it seems likely that there would have been a considerable further spread of the infection during the delay so that an inward extension with serious or even fatal result might have taken place.

The real test of treatment in such cases is not simply that the patient recovers, or the reverse; it is that the recovery begins immediately after treatment is administered, and that the healing is prompt, and with a minimum of scar.

The object of the incision is to permit the escape of pus and necrotic material. A small incision correctly placed will do this. It must pass through or at least reach the center of infection. When it does this it relieves the abnormal pressure of which the induration is evidence, and thus permits the blood to circulate normally through the tissues, destroying the infective agent and counteracting its injury. Until the physical signs indicate where the center of infection is located, an incision is of doubtful value. If it simply divides edematous tissue, it can have little effect upon the progress of the infection. This is illustrated by a case mentioned by Walton Martin.* The patient's whole face was swollen and he was desperately ill. Three long incisions were made in the cheeks and upper lip, but without reaching the center of infection, which autopsy showed to have been in the cavernous sinus. The failure of an incision which does not reach the center of infection is hardly an argument against an incision which does reach it, and thus relieves the patient.

What is to be said of the numerous other methods of treatment which have been employed in these cases of facial infection, all of which have their staunch advocates?

Heat, in whatever form it is applied, increases the blood circulation of the infected area, and may thus check the infected process, if it is not too severe. This power is clearly a limited one.

External antiseptics may destroy bacteria which are near the surface. Many a pimple has been aborted by pure carbolic acid, introduced into it on the point of a toothpick. Such measures cannot be expected to control infection which has passed beneath the skin.

The bactericidal power of the roentgen ray is also very limited.

If an antitoxin should be developed which would act as promptly and efficiently as the diphtheria antitoxin, it would be the ideal treatment; for it would be effectual wherever the infection was placed and it would leave no scar. The vaccines now available have some power in preventing recurrent attacks of boils, but

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* Martin, W. The fatal outcome of certain cases of staphylococcus infections of the face and lips. *Ann. Surg.*, 76: 13, 1922.

they are not sufficiently powerful to stop an acute infection once it has started. So we still have to rely on surgery in acute cases; but the possible aid of vaccine therapy in conjunction with it should be borne in mind.

Manipulation in any form is generally condemned. Squeezing may cause the contents of a pimple to squirt out on the surface, and thus provide efficient drainage. It may also press the pus inward instead of outward, and thus rapidly spread the infection. If the pressure is severe it bruises the tissues and thus provides a fine field for the growth of the infecting organisms. Even when a boil has been lanced anything more than the gentlest pressure to hasten the exit of pus is unwise; and even this is unnecessary.

Suction has been employed to bring the pus or necrotic material to the surface. It is incapable of producing the harm which may be caused by squeezing; but to be effective there must be an opening, either spontaneous or the result of incision; and if there is a free opening, the suction is not indispensable.

Turning now to operative measures, we find that the merits of a large incision have been extolled by some surgeons who have vigorously condemned a small incision. If the incision is correctly placed, and is large enough to provide an easy exit for the pus and necrotic material, it has all the advantages of a still larger incision, and it heals more promptly and leaves a smaller scar. It is true that a small incision requires careful watching lest it stick together or dry at the surface, while drainage is still required. This accident can be prevented by hot wet applications, or by the use of wet dressings, or by dressing the wound with an ointment. The incision should not be *too small*; but to extend it beyond the area of dense induration, into the adjacent tissue which is merely edematous, has no value. The proper length of incision was clearly shown in Case v. The ⅜-in. incision bisected the induration. It was later shown to have bisected the center of infection

exactly; for the tissue which was damaged beyond repair by the inflammation later appeared as a small slough on each side of the cut surface. This slough was not due to the incision, however, for it occupied only the central third of each cut surface.

Next in order of severity may be mentioned crucial and multiple incisions. These find their place, if at all, in more extensive lesions than the commencing suppurations considered here. Their chief advantage is the freer drainage they give, or the opening of more than one center of infection, should such exist. These ends can be gained, at least in many cases, by undercutting the skin along the edges of a single incision. This will open additional pus pockets, and if the under cutting is not too near the surface of the skin, and is not carried too far from its free edge, no necrosis of the skin will be produced. The scar will then be simply that of a linear incision.

A more radical measure is excision. H. Heinlein* says: "In dangerous furuncles of lip, cheek, etc. . . . we must excise, never incise." He says his elliptical excision should give 100 per cent recovery, and adds, rather naively, that the scars from the granulation process are "large but relatively smooth, and not very disfiguring."

Undoubtedly an excision will give very free drainage; but why sacrifice tissue in no way responsible for the infection, and which if properly handled will not interfere with the body's efforts to overcome the infection?

Another and more serious operative treatment, advocated by several writers, is the ligation of the angular vein, or the facial vein; or even the internal jugular vein. The history of surgery tells us of numerous peculiar operations which have been popular for a time, and then have been abandoned. One is inclined to look leniently upon them as belonging to the age of superstition, or at least to an age previous to the clear understanding of correct surgical principles. But what can

*Munch. Med. Wchnschr. Oct. 5, 1928.

be more peculiar than the ligation of a single vein to control infection? Apparently the reasoning runs as follows: Patients with a fatal facial infection sometimes die with suppurative thrombosis of the cavernous sinus. The angular facial veins are connected with the cavernous sinus. Therefore ligation of them will prevent suppurative thrombosis of the cavernous sinus.

Consider this hasty conclusion in the light of the following: Surgical pathology teaches that infection spreads chiefly by the lymph spaces and lymphatics, and only slightly by the veins. Ligation of a vein predisposes to thrombosis *proximal* to the point of ligation as is seen in numerous cases of ligation of dilated veins of the leg. Anatomically the facial vein has so many branches that freely anastomose with each other and with other veins, that ligation of one or two trunks must have only a very slight effect upon venous circulation. It seems incredible that anyone who has ever seen a wax-erosion preparation of the veins could think of affecting the flow of blood by ligation of a single vein.

All things considered, the conclusion seems warranted that infections of the face present no peculiarities which set them apart in their treatment from infections of other parts of the body; and that prompt correct incision of a focus of infection offers the best chance to check the infection locally; to limit its tendency to spread, and thus to favor a prompt cure of the patient. If one wishes a motto for his guidance in these cases, let him disregard one that has recently been offered, *Noli me tangere* and choose rather one with centuries of success to its credit, *Ubi pus, ibi evacua.*

THE OPERATIVE TREATMENT OF HALLUX RIGIDUS*

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THERE is no minor operation more likely to bring discredit to the surgeon than the attempt to cure a stiff great toe. I speak with experience as, for some years after the War, I did a considerable amount of Medical Board work for the Ministry of Pensions and examined a large number of patients who were supposed to have been cured of this condition. The results were thoroughly unsatisfactory and most of the patients had to be granted a continued pension. The technique of the operation is therefore a matter deserving some consideration.

In the unsuccessful cases referred to above the operation had consisted in the partial removal of the metatarsal head. The operators were evidently influenced by Sir Robert Jones' dictum that it is essential to leave the lower part of the head so as not to remove an important weight-bearing point of the foot. The after treatment had been carried out with that leisurely thoroughness so characteristic of state-paid hospitals; so that the unsatisfactory results can only be attributed to the operation itself. I have also had bad results myself from this operation, even when combining it with transplantation of the bursa as advised by C. H. Mayo; but I ascribed this to some possible error in technique. I now regard it as a thoroughly bad operation and I believe that the fear of removing too much bone is a fetish.

Hallux rigidus, when at a stage requiring operative cure, falls into two classes: (1) when the limitation is only in the movement of dorsiflexion; this should strictly be called "hallux non-extensus," and (2) when the joint is ankylosed either by fibrous periarthritis or by exostosis. The former type is very common and it is mainly this that I wish to discuss. There is a range of movement of about 45° of plantar flexion from the straight position but there is no dorsiflexion. The movement present is free and painless and the block occurs suddenly when the toe reaches the straight position. Examination of the articular surface in these cases shows an apparently normal cartilage and the limitation of movement is due to an overgrowth of bone (exostosis) along the superior articular margin. It would seem criminal to sacrifice the head of the bone in such a case but smaller excisions of bone have not been satisfactory. Mere removal of the exostosis is useless and an oblique section including some of the articular cartilage risks a recrudescence of arthritis and frequently gives rise to a greater overgrowth of bone than before. The treatment in these cases is as follows: the patient has about 45° of free painless movement in his joint but the movement is *in the wrong direction* to be useful to him. Any interference with this damaged joint is very likely to cause a recrudescence of arthritis and restrict movement still further. Therefore leave the joint severely alone and do a cuneiform osteotomy of the neck with the base of the wedge upwards. Keep well behind any exostoses; start with a small saw or chisel and complete it neatly with sharp bone forceps. Close the wedge-shaped gap by dorsiflexing the great toe as freely as possible and fix it in plaster for a month. If the dorsal exostoses are so big as to be causing a bunion they must be removed with the wedge but in this case it is difficult to avoid opening the

joint. The patient may get about in a special plaster boot as soon as the wound is sound. In this way you swing round the range of movement dorsally without any interference with the arthritic joint, and enable the patient to dorsiflex his toe enough for comfortable walking. It is very remarkable how little extra dorsiflexion is needed to make the patient comfortable. I generally dorsiflex the toe 45° (actual angle 135)° in plaster but the ultimate range of movement is generally much less than this, though the patient has no doubt about the relief given him. Browning was evidently thinking about this joint when he wrote: "Oh the little more and how much it is," for a few degrees of movement makes an enormous difference here and patients will complain of one side only when it needs very careful observation to detect the difference between the two. The only practical difficulty in this operation is to get the wedge cut from the bone to close up. There is a good deal of ligamentous resistance so one must use considerable force in dorsiflexing the toe and put on a strong plaster cast. The patient subsequently wears an ordinary boot which merely needs to be loose enough to avoid pressure on the joint.

In the second type of case when the joint is fixed or nearly fixed, this operation is of course useless. I have explained why I dislike partial resection of the metatarsal head; it results in a stiff toe again. Another operation sometimes practiced is resection of the proximal phalanx; this results in a flail toe which falls about in a manner ridiculous to behold and is entirely useless for progression. The operation which gives the best results is *complete* excision of the metatarsal head and it does not matter very much if the operator takes a generous view of the length of the neck! If this is done it matters not whether or no the bursa is transplanted but, as it is presumably an inflammatory tissue, I prefer to remove it if present. I like to fix the joint in plaster for ten days and let the patient commence walking in a cloth boot with a metatarsal bar in about a fortnight. The foot is not fit for really heavy work for about three months. One of my recent patients was a ward sister who had been compelled to give up her work owing to pain in the toe. The work of a hospital nurse is exceptionally hard on the feet; but in three months she was doing full duty again in complete comfort.

It remains to be mentioned that, if operation is contraindicated or refused, a clever bootmaker can generally make the patient comfortable by hollowing out a groove for the front of the great toe and fixing a thin metal plate in the inner side of the sole. This is so expensive however that the operation may be regarded as an economy.

CONTUSIONS AND ABRASIONS[*]

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NEW YORK

A TITLE such as this suggests the almost stereotyped diagnoses so commonly made during our ambulance surgeonship, a period which for many of us is now pre-pre-war.

Contusions bulk large in any statistical appraisal of the traumapathies, and of all the traumata they are doubtless the most common.

As to site, we recall that involvement of the scalp, the abdominal wall, the thigh, the calf and the joints attract attention most.

As to *gravity*, we appraise them as mild, moderate or severe.

As to *causation*, we recognize such factors as direct violence, and indirect violence, or both. A very common combination is contusion-sprain affecting a muscle group or a joint, when the accused trauma invokes a direct impact plus a twisting or wrenching violence. In this last group is that troublesome complex now so generally classified as "back injuries," or "low back strain," or "spinal contusion-sprain." Likewise, we revert to an almost equally puzzling group affecting such large joints as the shoulder, hip and knee.

Diagnosis rests upon the (1) history of injury, (direct, indirect, or both); (2) local pain, swelling, tenderness; dysfunction; (3) and later ecchymosis of variable extent. The *hematomata* are the circumscribed or encapsulated group so strikingly visualized in the scalp, along the margins of the iliac crest, and in the gluteal region.

There is a rare form, affecting chiefly the arm and less often the leg, to which the appropriate term "traumatic edema" is applicable. Here there is vaso-motor disturbance enough to suggest ischemia; indeed in the arm the syndrome of Volkmann's Ischemia is imitated, and in the lower extremity a pseudo endarteritis obliterans is apparently present. Recently the writer has had two such examples in the upper extremity, each the outcome of contusion-sprain. In one, there was violaceous swelling of the hand and forearm, surface coldness, and decided diminution of the radial pulse. This case resisted all forms of physiotherapy, suspension, traction, and splintage during a period of thirteen months. Realizing my impotency to benefit the patient further by these acceptable methods diligently practised by other surgeons, it was resolved to attempt arterial decortication, the Leriche operation. Accordingly the brachial artery was exposed in the upper arm and a cuff of the external coat was excised for a distance of about one inch. The outcome was dramatic and sudden in that next day the swelling, the color, the surface coldness and the pulse volume changed abruptly for the better. At this writing (12 weeks after operation) the extremity subjectively and objectively is practically normal and the patient has returned to work. The rationale of this "sympathectomy" procedure is in dispute, but in selected cases it apparently has merit enough to warrant trial in that group in which other accredited measures prove valueless. Less often has it proven successful in the lower extremity when practised by me for pathological processes already initiated in the blood vessels, as in various types of endarteritis with or without evident or impending gangrene.

IMMEDIATE TREATMENT OF CONTUSIONS

(1) Hot applications of tap water, saline solution, witch hazel or diluted alcohol.

(2) Plentiful dressings soaked in any one of the above.

[*] Submitted for publication January 31, 1929.

(3) Firm bandaging.

(4) Elevation and moderate usage.

INTERMEDIATE TREATMENT OF CONTUSIONS

(1) Application of hot compresses of soap suds.

(2) Massage with camphorated oil.

(3) Exposure to the rays of a 60–100 watt electric light.

Each of the above to be used 10 minutes two or more times daily.

This treatment is used so often that it is known on my records as SOL; S for soap, O for oil, and L for light.

Use of the part is insisted upon so that by self-massage, circulatory and muscular activity may be preserved.

LATE TREATMENT OF CONTUSIONS

Here we encounter such end results as pain, weakness, atrophy, dysfunction and perhaps the deformity of fibrositis or ankylosis. There also is often the non-co-operation of the patient due to fear, depression or desire; hence the morale and the moral may require as much of our attention as the physical and the clinical.

At this stage physiotherapy is of great value, and such measures should be *carefully supervised, directed, regulated* and *prescribed* by the surgeon himself. Of these, massage, dry or moist heat, the whirlpool bath, muscle exercises, the rowing and weight machines all have a place. Diathermy in some cases appears desirable; but it is not in my experience by any means the vaunted cure-all of some enthusiasts. As a means for producing regulated rhythmic motions for stiff or contracted muscles or joints, the writer has recently perfected a motor-driven portable device capable of a sustained pull from zero to 150 pounds. This machine has a pull-and-let-go action (a systole and diastole) which allows gradual stretching or elongation of the involved elastic muscle, tendon, fascia or capsule. It can be used for any set of muscles and for any joint. As a means of reducing dislocations or fractures it is

quite effective, as it in reality motorizes fracture tables or traction devices.

In this respect it is comparable to the advance made on the hand saw by the motor saw.

However, of all forms of physiotherapy, return to work is the best measure not only from the physical but also from the psychical side. By this is not meant substitute work nor vocational therapy; these alternatives apparently are most applicable to the grossly handicapped.

Idleness is a bane to the injured, and light work preliminary to regular work is a blessing. There is no place in the day time home for the average workman, except on Sundays and holidays, and "to have to hang around the house" is a bad thing for the patient and not a good thing for the wife or family.

The stimulus of "being back on the job" is immeasurable and it is better to be a limping water carrier in the procession than to stand on the curb and feebly cheer as the parade of your own passes by.

The gross defects, such as contractures and anchylosis are obviously problems outside the scope of this brief survey.

For the *hematomata*, pressure ordinarily suffices. If aspiration or incision is attempted, it should be delayed for 24–72 hours and then performed with every attention to asepsis. To "suck out the blood" of a hematoma without due care is on a par with the probing-for-the-bullet type of surgery so common some years ago.

There is enough for the medical examiner to do now without adding our meddlesome efforts to his burdens.

In passing it is pertinent to say that many fractures of the skull are associated with hematoma of the scalp. X-ray or incision are the best means of differentiation, and even the most careful palpation and erudite explanation cannot supplant these diagnostic criteria.

ABRASIONS

The chief interest and importance in this class of injury is because they are so

numerous and are potential sources of infection.

Sites commonly involved are the hands and feet, the naso-labial region, the shin and the outer surface of the thigh.

Extent varies from an almost imperceptible scraping to a large surfaced "brush burn" so often seen on the thigh. On the hand and on the face (notably continguous to mucous membranes) small lesions may assume a gravity entirely disproportionate to their initial extent.

Symptoms are practically limited to slight bleeding, swelling, soreness and dysfunction. If infection appears, we have in addition variable cardinal signs of cellulitis, with or without systemic effects.

Treatment primarily aims to prevent infection, and with that in view the essential step is to sterilize and protect the affected area. This is best accomplished by gentle soap and water applications, reinforced if necessary by grease solvents such as gasolene, benzine or kerosene. Drying is the next step, and then iodine (full strength tincture) should be applied freely. If the area is small, a patch of flamed adhesive is an ample protective. If however, bleeding is free or the area is large, a layer or two of sterile gauze should be applied, and over this the adhesive is then fastened. In a finger or on a limb, the adhesive should be placed spirally so that circulation will not be impeded.

In the treatment of any wound (and abrasions *are* in the wound class) we should never forget that any wound not made with surgical intent is already infected and should be so regarded. Hence the basic problem in the treatment of every break in the integument is actually the treatment of potential or actual infection. Antiseptics in and of themselves are of no absolute value, and the experience of ages is to the effect that their potency is often over estimated by enthusiastic advocates. Each generation furnishes some "new and powerful antiseptic" which is supposed to have superlative merits. This "discovery" is tried for a time and then goes into the discard of numberless predecessors.

Among other things, an antiseptic is supposed to be a germ killer, a solvent of secretion, a fixative of tissues, an irrigating medium, a deodorant. Any chemical possessing these five elements would be valuable in the treatment of infected wounds, if at the same time it did not kill the tissue cells, if it had penetrating powers, if it did not coagulate albuminoid material, and if by absorption it did not damage the kidneys or other organs. During the War, it has been stated that over 200 different antiseptics were tried out in the greatest field and under the most adverse and diverse conditions ever afforded for the practice of traumatic surgery, and at the end of it all, the surgeons of greatest experience concluded that chemical sterilization was of doubtful value by comparison with mechanical sterilization (debridement).

Just now we are in the waning throes of another propoganda promising wound salvation if we would but employ a popular wound rouge, or else a colorless preparation once regarded as a sovereign remedy in certain kidney infections. Surely as a profession we are a gullible lot and apparently will not learn from our own previous experience or that of our forefathers!

Hence in the treatment of an abrasion or any other wound due to trauma, we must not rely on the cleansing or disinfecting power of any antiseptic. Plentiful use of soap and water is the best safeguard so that the field may be rendered as surgically clean as possible. If any antiseptic is used at all, let it be one that has proven harmless locally and systemically, and with this in view the oft tried tincture of iodine is advised.

Infected abrasions are problems in the management of cellulitis, or localized ulceration. The former usually responds to hot wet dressings of magnesium sulphate (saturated solution). No incision should be made until pus localizes, as indicated by local pain, fluctuation or induration.

Ulcers following abrasions usually respond to the open exposure method by which the area is exposed to the rays from the sun or from a 60 Watt electric light bulb. In the interval, the ulcerated area is covered by gauze soaked in equal parts of olive oil and camphorated oil. If the ulcer is large, a frame made of "Celoglas" (artificial glass) is an excellent protective. This provides a glorified vaccination shield made of thin meshed galvanized wire (like window screens) into the meshes of which an acetone preparation has been poured. This is light, translucent and transmits violet rays. Placed over a wound it makes a flexible tent or housing so that the dressings need not actually contact with the raw surface.

As in contusions, we must not forget the practice of using the part within the limits of producing pain, for self use means better circulation, new blood supply, less edema and more flooding of the part with natural protectives. Hence mobilization and not immobilization has a place in the treatment of these traumata just as it has a place in the treatment of bone and joint injuries.

THE TREATMENT OF
INJURIES OF THE CHEST*

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THE presence or absence of a pneumothorax following a chest injury is of such importance in the treatment of a case that any study of thoracic injuries must naturally be divided into two parts: cases with a pneumothorax and cases without a pneumothorax.

. When the wound in the chest wall remains open so that there is a direct path from the pleural space to the exterior, the pneumothorax is called an open pneumothorax. The changes in the physiology of respiration in the presence of an open pneumothorax are profound. The lung on the side of the wound can collapse because air can be sucked into the chest cavity to take its place. The lung on the opposite side can also contract because the mediastinum is a very elastic membrane, and in the otherwise normal individual offers practically no resistance to the pull of the lung. If the wound into the pleural cavity is large enough, or if the patient makes no more inspiratory efforts, both lungs will finally collapse almost to the limit of their elasticity. However, one of the very first reactions to an external opening into the pleura is a forced inspiratory effort. The diaphram descends, the ribs are elevated and thus spread outwards, and a very rapid increase in the size of the intra-thoracic cavity results. This increase in capacity causes a suction action. Where normally the trachea is the only inlet through which air can be sucked, in the case of an open pneumothorax the air can be sucked through the wound. Depending upon the relative sizes of the openings of the trachea and the wound, the relative amount of air gaining access to the lungs and to the pleural space will vary. How-

ever, even with a very large wound of the chest wall enough air will gain access to the lungs through the trachea as a rule, to maintain life provided the patient is at absolute rest and the lungs in otherwise good condition. The air entering in through the wound fills the pleural space on the injured side, and allows the mediastinum to be sucked to the contralateral side. The forced expiration following will reverse the conditions. Air will be forcefully ejected from the sound lung through its bronchus. Most of the air will be forced out through the trachea; some of the expired air may be forced into the lung on the injured side. The mediastinum will be forcefully pushed over to the injured side. Much of the air in the pleural cavity on the injured side will be expressed through the wound. Thus there will be a sucking sound heard at the wound during inspiration, as air is drawn into the pleural cavity and a hissing sound during expiration as air is forced out of the pleural cavity.

Summing up the effects of the open pneumothorax we find: first, a collapse of the lungs with a marked diminution in the amount of air gaining access to the alveoli of the lungs; second, violent inspiratory and expiratory efforts on the part of the patient; third, a further reduction of available air because of the interchange of air from the so-called sound lung to the lung on the injured side; and fourth, a violent swinging back and forth of the mediastinum.

The patient is usually a pitiable sight, cyanotic because of lack of oxygen, making tremendous respiratory efforts to overcome the diminution of absorption area in the lung, and frequently in shock because of

*Read before the Society of Industrial Surgeons, Chicago, Jan. 7, 1929.

the sudden shifting of the mediastinum with its vital organs.

If the wound into the pleura can be
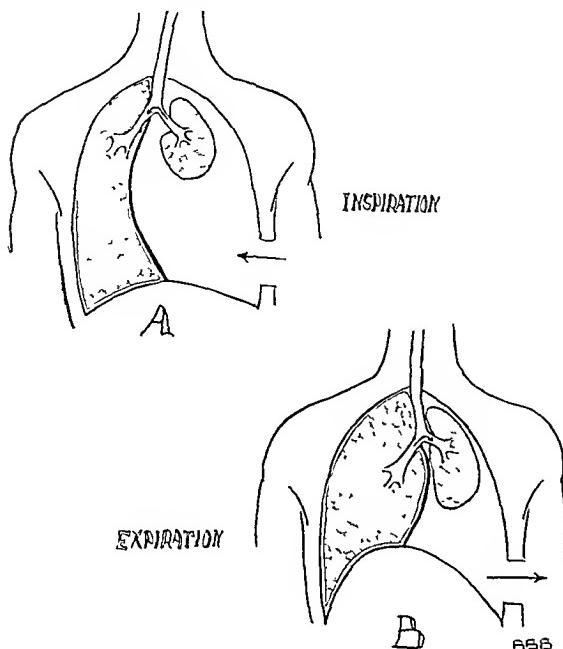
FIG. 1. Diagrammatic drawing. Mechanism of respiration in case of open pneumothorax. A. In inspiration homolateral lung has been able to collapse because air can be sucked in through opening. Contralateral lung collapsing almost to the same degree because the mediastinum can be sucked over. B. At the end of forced expiration, compression on contralateral lung by chest wall and diaphragm forces air out of bronchi, pushes over mediastinum. Reduction of size of chest forces air out through opening. Some air is forced from contralateral lung into homolateral lung. Diagram shows reason for sucking sound at wound, for diminution in aerating surface of lung, for violent mediastinal swinging and also mechanism of so-called "pendel luft."

closed by pulling the skin margins together, or by means of a wet towel, or even by means of the palm of the hand, the entire picture may change within a few seconds in a most startling manner. The easiest and most readily available material at hand to close the chest wound is the margin of the wound itself. If one margin of the wound can be pulled over the other, the following changes occur: The next inspiratory effort causes suction as before. Now, however, no air, or but very little air, can be pulled in through the chest wound but all or most of the air comes in through the trachea. Thus the lungs

themselves will receive as much air as is required to fill the increase in the intrathoracic cavity, brought about by the violent inspiratory effort. The next expiratory movement forces air not only out of the lung through the trachea, but also out of the pleural cavity because if lightly held together the upper margin of the wound will act as a valve flap which is lifted as air is pushed out and shut as air is sucked in. The lung on the injured side and also the contralateral lung will be expanded still more during the next inspiration, and during the next expiration still more of the air in the pleura will be forced out. Thus after but a few respiratory cycles the pneumothorax may be almost entirely overcome, and the lungs practically completely expanded. As soon as sufficient aeration occurs the cyanosis disappears. With the disappearance of the carbon dioxide stimulation, respiration becomes easier and more normal, and with the obliteration of the mediastinal flutter the patient frequently recovers from shock. In a few moments the picture presented by the wounded individual has changed from that of a person apparently or actually gasping his last, to one whose appearance is no worse than if the trauma had been received in some other part of the body.

Our first cardinal rule in the treatment of injuries to the chest wall is: immediately close any sucking wound in the chest.

In many cases the wound of the chest naturally falls together as soon as the trauma which has caused the wound is over. This may apply to such wounds as gunshot wounds of the chest, stab wounds, or perforations of the chest in which the perforating object itself plugs the opening or in which the wound margins fall together when the perforating object is removed. Some air may have gained access to the pleural cavity during the trauma. This is now imprisoned and a so-called closed pneumothorax has occurred. At times crushing injuries to the chest may injure the lungs without actually breaking the continuity of the external thoracic wall.

In such cases, such as with a broken rib, air will often have escaped from the torn lung and result in a pneumothorax. The difference in physiology between a closed and an open pneumothorax is very great.

The lung on the injured side will be partially collapsed, the mediastinum will be sucked over and the lung on the opposite side also collapsed. However, the next inspiratory effort will enlarge the intrathoracic cavity, which as before will result in a sucking in of air to fill the newly made space. In the case of a closed pneumothorax, however, none of the air will be pulled into the pleural space, but all of it will come into the lungs from the trachea. The expiratory effort will force the air out of the lungs through the trachea in the same way that a forced expiration, such as a sneeze, forces the air out of normal lungs. There is apt to be some mediastinal flutter brought about as follows: During the forced expiration the captured air in the pleural space of the injured side becomes compressed by the pulling inwards of the chest walls and forces the mediastinum over towards the sound side, the next inspiration will overcome this compression and allow the mediastinum to return to its former position only to be pushed over by the subsequent expiration. This mediastinal flutter is exactly opposite in its swing to that produced in an open pneumothorax, is much less marked and produces much less shock.

The amount of dyspnea produced by a closed pneumothorax depends chiefly on how much air has entered the pleural cavity and as a result, how much the lungs have collapsed. This can be expressed technically by saying that the amount of dyspnea varies with the diminution in the vital capacity. By inserting a needle into pleural cavity and aspirating air the size of the closed pneumothorax can be reduced.

Thus another rule in treatment can be laid down. In the case of a closed pneumothorax, if the injured patient is in extreme dyspnea because of marked reduction in his vital capacity, air can be aspirated from

the pleural cavity, expanding the lungs and increasing his available aerating surface. This should be done only if
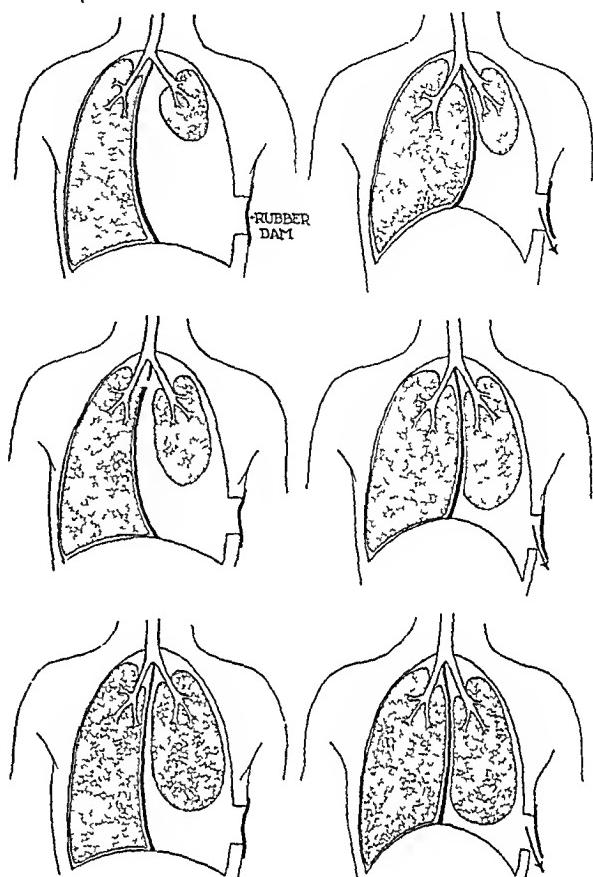
Fig. 2. Mechanism of treating open pneumothorax. Inspiratory efforts pull rubber dam firmly to chest wall. Expiratory efforts allow air to escape from chest wall. After the completion of a comparatively few respiratory cycles pneumothorax has been practically overcome.

absolutely necessary because expanding the injured lung may result in an increase in bleeding and in the development of still another type of pneumothorax.

Sometimes a crushing or perforating injury to the lung causes what we might term an internal open pneumothorax. In this case the wound in the lung gapes as the lung is expanded during inspiration and air is drawn into the pleural cavity. With the next expiratory effort the pressure on the lung closes the lung wound, and the pleural air can not escape. The following inspiration reopens the wound and draws still more air into the pleural cavity

allowing the lungs still further to collapse and at expiration again no air is forced out. More and more air is thus gathered in
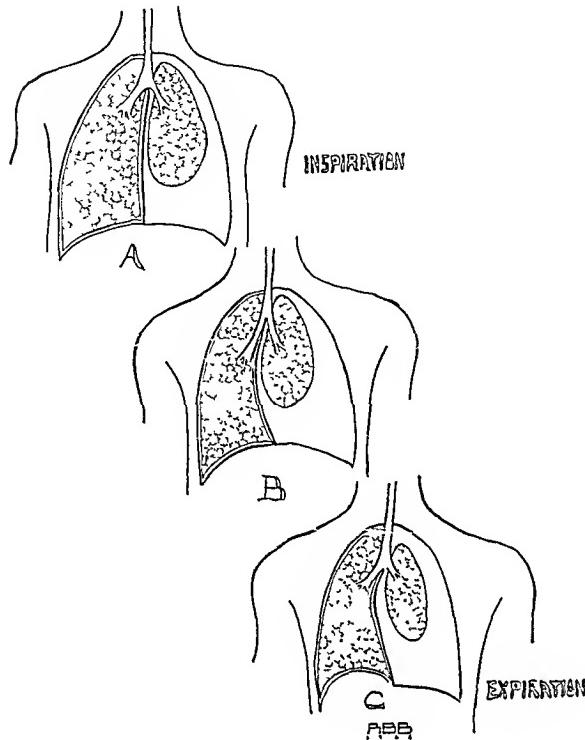
FIG. 3. Diagrammatic reproduction of mechanism of closed pneumothorax. A. Chest in middle of cycle showing collapse of homolateral lung, contralateral lung with shifting of mediastinum. B. At end of deep inspiration both lungs have increased in size equivalent to the increase of intrathoracic cavity. C. Expiration. Compression of lung fields has allowed both lungs to collapse. Imprisoned pleural air causes compression of contralateral lung and shifting of mediastinum towards contralateral lung.

the pleura on the side of the injured lung. The injured lung is collapsed more and more, the mediastinum can be sucked more and more to the opposite side allowing collapse of the opposite lung. There is less and less available air space. The anoxemia increases with the increase of the carbon dioxide tension. Deeper and deeper inspiratory efforts are made with the result that the pneumothorax is still further increased. Eventually the intrapleural pressure is actually positive except for a short period at the very height of inspiration. When this happens both lungs will be almost fully collapsed even at the end of inspiration and the patient will die of suffocation.

The treatment is obvious. The air sucked into the pleural space during inspiration must be allowed to escape during expiration. This can be accomplished by making an opening in the chest wall as follows:

If the case is first seen in the hospital, the thoracotomy can be carefully performed, a large-sized rubber tube can be inserted into the pleural cavity and the external opening of the drainage tube closed by a water valve made by attaching the drainage tube to a long tube which is dropped into a jar filled with water. In this way air will be forced out of the chest during expiration but during inspiration fluid will be sucked up into the tubing. If the water level is several feet below the lung wound a negative pressure many times that produced by a deep inspiration is necessary to suck the water up to the chest cavity. However, to avoid any danger from such a contingency, the jar used is sterile and a mildly antiseptic solution is used instead of water. If no tubing is at hand it is still possible to overcome the internal pressure pneumothorax by making a stab wound in the chest and then forming a flap, by pulling one wound margin over the other, as described under treatment of open pneumothorax. After the first shock has been overcome the chest cavity should be opened and explored and the lung wound sutured.

A third rule in the treatment of thoracic cases can be formulated as follows:

In the presence of marked dyspnea associated with violent respiratory efforts ascertain the intrapleural pressure either by means of a manometer or by inserting a hollow needle into the chest wall and seeing whether air is sucked in or forced out. If an actual or relative positive pressure internal pneumothorax exists allow for the escape of the pleural air.

Hemorrhage is another cause of death from injuries to the thorax. The most usual source of hemorrhage which can be controlled is from the intercostal vessels. This applies particularly to perforating wounds

and to injuries which have caused fractured ribs. Whenever there is an open wound with signs of hemorrhage, bleeding from the intercostal vessels must be suspected. The intercostal vessels are fairly inaccessible, but can be easily compressed by passing a ligature completely around the rib. Thus one might almost be permitted to lay down another rule, to wit: If bleeding is severe after a wound of the chest wall, the intercostal vessels above and below the wound should be controlled by passing ligatures around the ribs both posteriorly and anteriorly to the wound.

When the symptoms from bleeding are not marked, and apparently no other intrathoracic lesion has occurred, it maybe advisable to practice watchful waiting. Frequently after a certain time no more bleeding will occur into the pleural cavity. In this case, the question arises whether or not to aspirate the blood. In my opinion, where this can be done with an exacting aseptic technique, it is preferable to remove the blood than to let it absorb. No attempt, however, should be made to do this within the first forty-eight hours, lest, as a result of the procedure, the hemorrhage recurs.

In case of large hemorrhages blood transfusion should be done.

If the bleeding comes from an injury to one of the large intrathoracic vessels, little or nothing can be done. The hemorrhage is usually so severe that death occurs before steps can be taken to control the bleeding.

If the lung is lacerated enough either to produce severe pneumothorax or cause severe bleeding from the lung tissue itself, the lung wound should be sutured. The lung tissue is exceedingly friable and therefore it is difficult or impossible to suture it in the usual way. By taking two strips of fascia lata, or strips of intercostal muscle and fascia, and laying these strips on either side of the lung wound, it is possible to close the wound by having the sutures go through the tough strips. This

method is easy to carry out and is successful. If the laceration of the lung is confined to part of one lobe, it sometimes will be
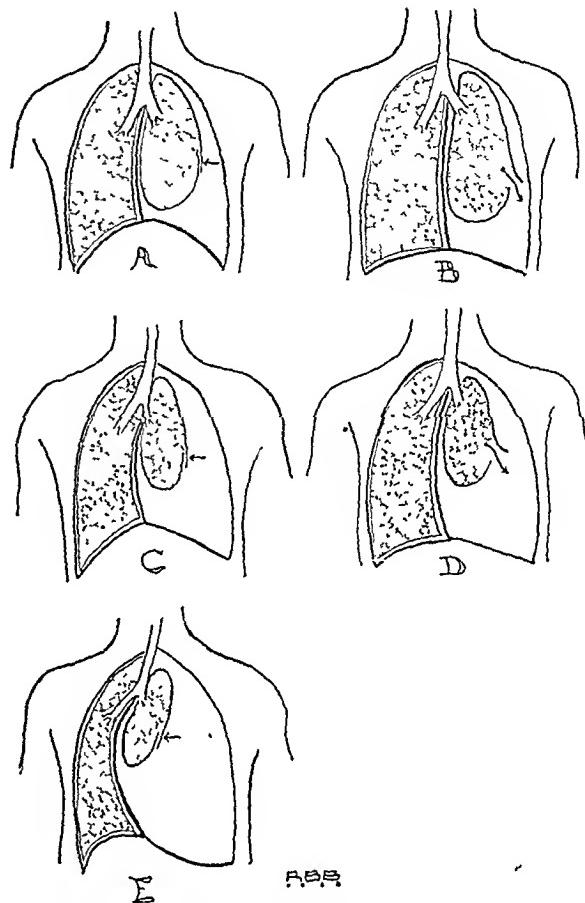
Fig. 4. Mechanism of internal pneumothorax with valve action due to lung wound. A. Pneumothorax lung wound closed. B. End of deep inspiration shows lung wound open by increase negative pressure with increase in amount of air in pleural space. C. End of inspiration, lung wound is closed. Pleural air cannot escape. Shifting of mediastinum; collapse of contralateral lung. D. End of next inspiration. Lung wound reopened, still more air permitted in pleural space. E. End of inspiration. Lung wound closed. More pleural air imprisoned with greater shifting of mediastinum and collapse of contralateral lung.

easier to remove the injured portion of the lung.

Operations within the thoracic cavity have lost most of their danger since the perfection of the gas anesthetic machines.

The pressure at which the gas is delivered can be increased by opening the valves farther than usual, and by making digital pressure over the outlet valve on the mask. If now the mask is held very tightly to the patient's face, especially if the face has

previously been well vaselined, enough pressure can be obtained fully to expand the lungs even if the pleural cavity has been opened through a long intercostal incision and held apart by rib spreaders. In this manner the surgeon can operate at leisure without fear of the open pneumothorax produced.

The thoracic cavity can be explored as easily, if not more easily, than the abdominal cavity, and there is no more reason why injuries to the lungs should not be repaired than injuries to the intestines. It is as illogical to rely on coagulants, drop in blood pressure, gravity, etc., to control intrathoracic bleeding as it would be to control intra-abdominal bleeding.

Another fundamental in the treatment of thoracic injuries is that unless there is reasonable assurance that the results of the trauma are such that they will take care of themselves without other interference, trauma to the chest should be given the same benefit of exploration as is now wisely accorded to trauma to the abdomen.

CONCLUSIONS

In injuries of the chest:

1. Immediately close all sucking wounds.

2. In the case of a closed pneumothorax which has been carefully diagnosed, if the injured person is markedly dyspneic aspirate air from the pleural space.

3. In the presence of marked dyspnea following a chest injury, ascertain the intrapleural pressure by means of a manometer, and by inserting a hollow needle into the chest wall and seeing whether air is sucked in or forced out. If a positive pressure internal pneumothorax exists allow for the escape of the pleural air.

4. Hemorrhage in chest injuries is frequently from the intercostal arteries running under the broken ribs. These arteries are best controlled by encircling the entire rib with a heavy suture.

5. Large lacerations to the lungs should be repaired.

6. The thoracic cavity is as easily explored as the abdominal cavity.

7. Unless there is reasonable assurance that the results of a trauma to the chest are such that they will take care of themselves without interference, trauma to the chest should be given the same benefit of early exploration as is now wisely accorded to trauma to the abdomen.

CIRCUMCISION*

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WHILE circumcision has been employed as a religious rite of sacrifice for centuries, in modern times this procedure has been utilized either as a prophylactic measure or as a therapeutic expedient. Circumcision, being one of the less technical surgical operations, may be performed rather simply on newborn infants; however, surgical details should be followed with precision. Without any induced anaesthesia and under proper aseptic conditions, using 1 per cent picric acid solution or 3½ per cent tincture of iodine for preparation of the skin, careful inspection of the external genitalia should be made for congenital phimosis or excessively redundant prepuce. This is important so that subpreputial adhesions may be severed by the introduction of a grooved director or probe between the glans penis and the foreskin. The prepuce is forcibly extended beyond the glans and with scissors or scalpel the redundant portion is excised in a circular manner. Care must be taken to avoid injury to the glans, as such injury might cause a permanently constricted meatus. If the remaining mucous surface extends too far beyond the coronal sulcus, an additional portion may be trimmed; As a rule the only bleeding point is near the frenum, and this should be clamped and ligated with No. 0 plain catgut. In common with the ritualistic procedures, some surgeons do not suture the severed edges, but assuredly it is better technique to place No. 0 catgut sutures in four different places about the coronal sulcus for better wound approximation. These stitches should be placed in the following manner: one at the frenum, one on the dorsum in the midline above and one on each lateral aspect. No dressing need be employed save a piece of sterile gauze over the penis for protection against the clothing. A dry sterile dusting powder or boric acid ointment should be spread about the genital region.
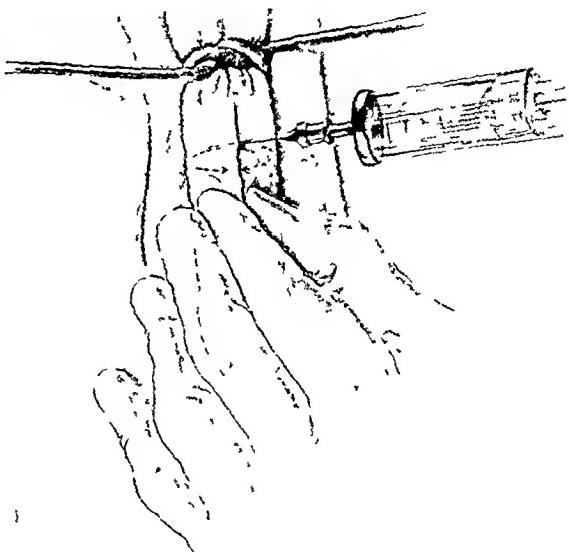
FIG. 1.

CIRCUMCISION IN ADULTS

In male adults circumcision is usually employed for redundant prepuce or for acquired phimosis due to a subpreputial pathological condition. The operation can well be performed under local infiltration anesthesia, using 1 per cent or 2 per cent novocaine solution. Under strictly aseptic precautions and with the skin prepared with 2 per cent picric acid solution, a rubber tourniquet is placed rather snugly about the shaft of the penis and a circular wheal of anesthetic is made 2 cm. proximal to the corona glandis. The needle should not be removed from the subcutaneous tissues during this entire procedure, as is well illustrated in Figure 1.[1] After the

[1] Original illustrations are the property of the Department of Urology, New York Post-Graduate Medical School and Hospital.

* Submitted for publication February 13, 1929.

wheal has formed (Fig. 2) a period of five minutes should elapse before the incisions are made. Two mosquito clamps are placed

on the dorsum almost to the corona glandis, the blunt blade of the scissors being placed between the glans and the mucous surface
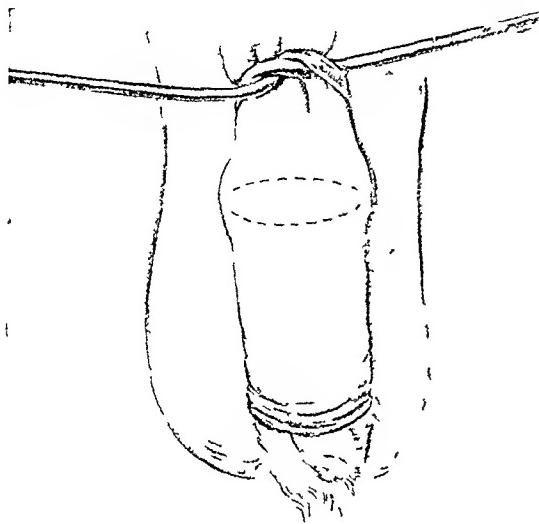
FIG 2.
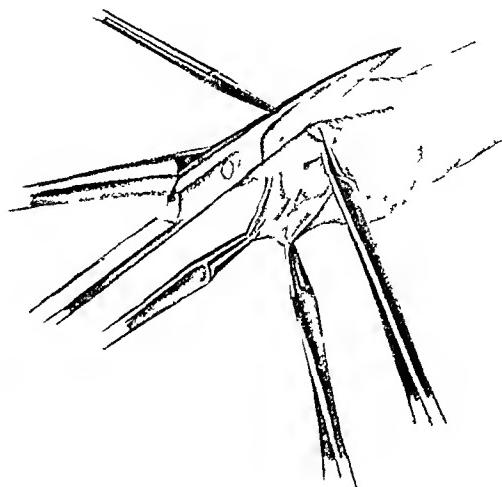
FIG 3

close together at the muco-cutaneous border of the prepuce on the dorsum in the median line, and two similar clamps

of the prepuce. At the bottom of this incision a No. 1 plain catgut suture is tied, leaving the ends long for traction. A
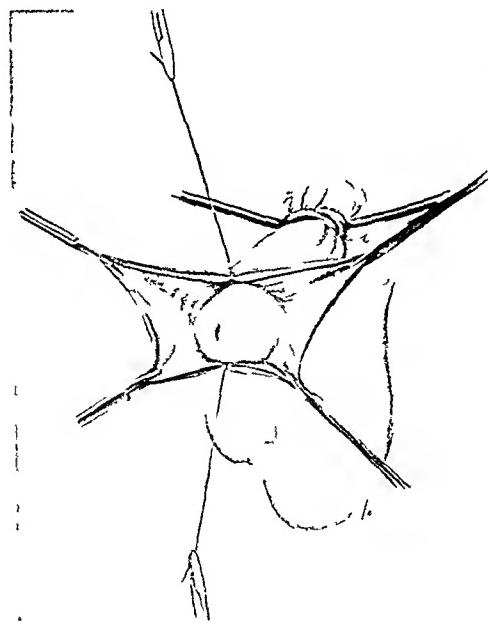
FIG 4
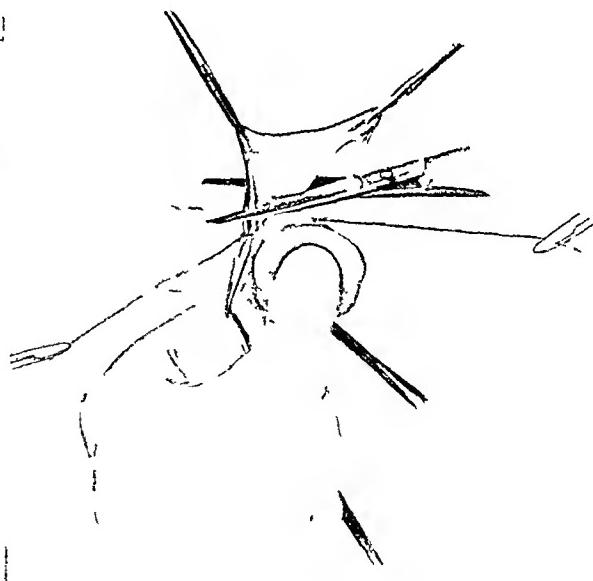
FIG 5

are placed to each side of the frenum below (Fig. 3).

Care is now taken to break up any subpreputial adhesions. An incision with scissors is made between the two clamps

similar incision and suture are made between the two clamps near the frenum (Fig. 4). The two flaps of prepuce are then resected close and parallel to the corona glandis. The tourniquet is then removed

and all bleeding points are carefully ligated (Fig. 5). Additional plain catgut sutures are placed laterally, four or six in number,

is exposed (Fig. 7). This dressing will serve to prevent the premature loosening of the sutures.
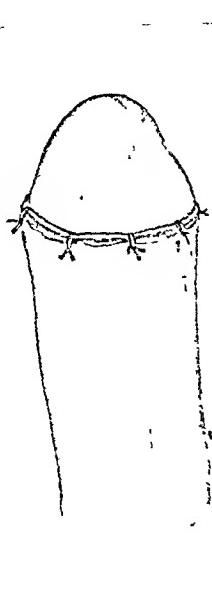
FIG. 6.
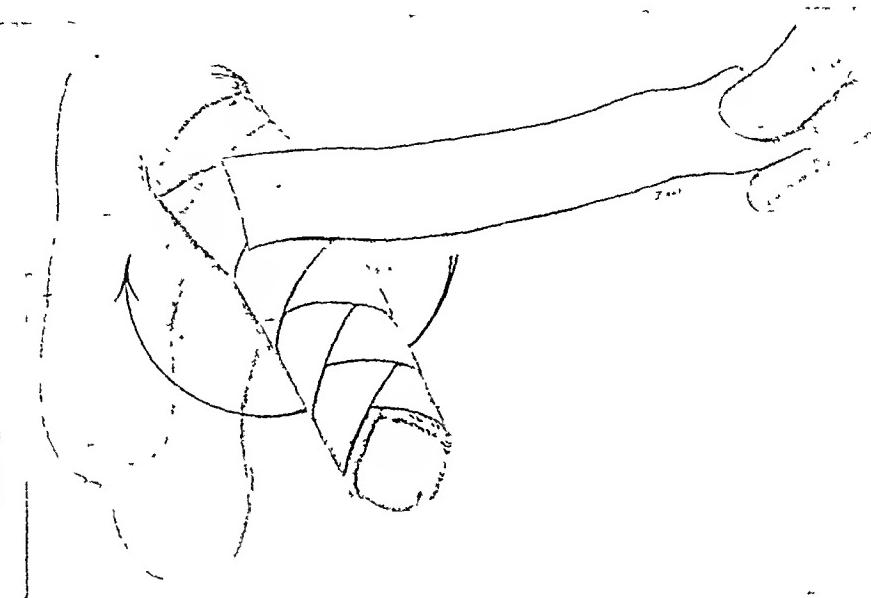
FIG. 7.

depending upon the necessity for wound approximation (Fig. 6).

If the suture ends have not been cut short, a piece of vaseline gauze may be tied about the coronal sulcus. Otherwise dry sterile gauze is placed over the wound and a figure 8 adhesive plaster dressing is applied so that most of the glans penis

If a glandular or subpreputial chancre or chancroid be present with its consequent phimosis, dorsal or lateral slits only for better drainage should be made, care being taken to avoid incision of the lesion. Secondary circumcision in the aforesaid manner should be performed only when the lesions have been completely healed.

THE TREATMENT OF
BOILS AND CARBUNCLES*

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BOILS

WHILE general treatment is important in all cases of boils, in persistently recurrent ones it supersedes local measures. The general health should be improved and efforts should be made to increase the resistance of the individual to the infective microorganisms. Tonics, sulphur, yeast, light diet and catharsis, rest, sunshine and fresh air are generally recommended. In addition to these measures, staphylococcic vaccines or injections of colloidal manganese are valuable.

The local treatment varies in accordance with the location, stage of development and extent of the lesion. In general the value of radiotherapy in the treatment of acute and chronic pyogenic infections, especially furunculosis, has not been commonly recognized. While radiation should always be used as an adjunct to other forms of therapy. it has a striking value when properly applied. It is a painless method, aborting early lesions, with prompt relief of discomfort and without scarring. Roentgen and ultraviolet therapy have specific indications.

Incipient Lesions. When the lesions are incipient and acutely inflammatory, a suberythema exposure of filtered roentgen rays hastens the localization and in small lesions may be abortifacient. One roentgen-ray treatment usually suffices, rapidly relieving the pain and causing prompt involution. In the radiation of a furuncle the surrounding area is included as such exposure seems to prevent the development of neighboring lesions. On hairy parts the dosage should be one-half of an erythema dose, and on non-hairy parts it may be a little greater. I prefer filtration through 3 mm. of aluminum. The earlier an incipient lesion is treated, the more prompt is the involution and the greater the likelihood of a cure without suppuration. These benefits are of special advantage when parts of the face above the mouth are involved because such infections must be handled with caution on account of the danger of thrombophlebitis and meningitis.

Well-directed ultraviolet treatment will in many cases cause the disappearance of a furuncle if applied in the early stage. At this time blistering exposures given to a wide margin about the lesion yield excellent results. Carbon-arc or mercury-arc lamps produce benefits that often equal those from filtered roentgen radiation, one treatment being generally sufficient. The exposure produces an intense congestion and apparently stimulates the local defence, so that frequently one treatment causes complete involution. The local action on the lesion is directly bactericidal, and there is an increased blood supply to the part, with an augmentation of the lymphocytes and phagocytes. After the treatment a dressing of ichthyol ointment is applied. Other abortive methods of treatment such as carbolization and electrodesiccation have given relatively little satisfaction in my hands.

When the lesions are incipient and acutely inflamed, incision should be strictly avoided. Hot poultices should be applied every few hours and the part should be covered with a wet dressing of alcohol or liquor alumini subacetatis; ammoniated mercury ointment, or 10 per cent ichthyol in basilicon ointment (ceratum resinae, U.S.P.). These measures should be continued until the pain and redness have subsided and the process has become localized and inactive with frank pus.

Localized Inactive Lesions. When the boil has become localized and inactive and shows definite fluctuation, free incision with drainage should be executed without delay. Following incision, healing is hastened by distance radiation with ultraviolet light, producing first-degree reactions. The treatments should be given every alternate day.

Recurrent or Chronic Type. In recurrent or chronic furunculosis confined to localized areas, fractional unfiltered or filtered roentgen rays often stop the development of further lesions and relieve conditions that have failed to respond to surgical measures. Filtered roentgen rays seem more efficacious than unfiltered for this purpose, but good results are accomplished by both methods. The dosage may be one-fourth of an erythema at weekly intervals, or three-fourths of an erythema at one sitting, without further exposures. An erythema should be studiously avoided although in stubborn cases an epilation is justifiable and beneficial.

On recurrent boils of the scalp, roentgen rays may be used with caution. Spectacular results sometimes have followed the administration of one fractional treatment. When the disease is recurrent on the back of the neck, no treatment equals filtered roentgen rays. Accurate arrangement of the patient and focussing are extremely important in this difficult location if the best result is to be expected. In recurrences of the disease on the scalp and the back of the neck, it is imperative to keep the scalp free of dandruff by local antiseptics. Ultraviolet radiation from a distance is useful for this purpose and simultaneously exerts a direct beneficial influence upon the furunculosis. In axillary cases, rest in bed with the arm away from the body is a measure of some importance. In treating the buttocks, the testicles should be screened by lead. Affections recurring on the vulva or perineum should be treated by fractional filtered roentgen rays in either the lithotomy or knee-chest position according to the best exposure. The parts should be kept scrupulously clean and free from the irritation of discharges, clothing or walking.

Generalized ultraviolet light baths for tonic effect should be given in all cases of recurrent boils. When lesions are widely disseminated on distant parts of the body, considerable reliance must be placed upon these treatments. Violent reactions or more than slight peeling should be avoided.

Ultraviolet light baths also give striking results in the treatment of multiple furunculosis in infancy. Usually this group of cases is treated surgically but in my hands better results have been attained by limiting incision to a minimum and by relying to a large extent upon actinotherapy and the use of local antiseptics, especially 3 per cent ammoniated mercury ointment.

CARBUNCLES

Carbuncles may be of the superficial or deep type.[1] The common superficial variety is characterized by pronounced cutaneous redness, multiple skin perforations in an early stage and, after sloughing, does not leave a very deep excavation. In the deep type, the lesion seems brawny and fixed like a malignant tumor; and there is late perforation and sloughing with deep crater formation.

Superficial Type. Roentgen therapy is almost a specific in lesions of the superficial type, causing prompt relief of pain, softening and evacuation of pus and rapid recovery. In lesions on the nose and the upper parts of the face[2] this method has special importance. Numerous authors have reported striking results from roentgen therapy of carbuncles. In general the indications, technique and dosage are the same as described for the incipient stages of furunculosis.

Carp[3] has compared the following four

[1] Philips, S. A dissertation upon carbuncles. *Lancet*, 1: 61–65, 1921.

[2] Roeder, C. A. Ligation of the angular vein in infections of the upper lip. *J. A. M. A.* 90: 272–273, 1928.

[3] Carp, L. Treatment of carbuncles. *Ann. Surg.*, 86: 702–706, 1927.

different methods of treating carbuncles: by roentgen ray, by surgery, by conservative therapy and by autogenous blood circuminjection. His work is based on a study of 153 patients with non-diabetic and diabetic carbuncles admitted to the Presbyterian Hospital, New York, in the past ten years.

The statements concerning dressings and the local and generalized exposures of ultraviolet radiation in the treatment of incipient furunculosis apply equally well to the superficial type of carbuncle. Both roentgen and ultraviolet therapy are usually dynamic in causing rapid regression, relief of pain and evacuation of the detritus.

Deep Type. In the deep type of carbuncle, radiation therapy is invariably of some benefit, preference being given to filtered roentgen rays. However, the results are not so good as in the superficial types, and one should beware against toying with radiation therapy when surgical procedures are definitely indicated by deep spreading or severe general intoxication, especially in patients who have low resistance. Extensive crucial incision going well beyond the inflamed margin, elevation of the flaps, and trimming away of necrotic material should be done under gas and oxygen anesthesia without delay, the cavity being packed with gauze soaked in Schlumsky's solution (phenol 30 per cent, camphor 60 per cent, alcohol 10 per cent). Healing is expedited by local and general actinotherapy.

The electric cautery, electrocoagulation and the electrothermic cutting current are recommended as superior to the scalpel by different advocates. Willmoth described electrocoagulation treatment which may be done under local anesthesia except in severe cases, which require ether. A full-strength hyoscine, morphine or cocaine tablet two and one-half hours before operation, augmented by one-half strength tablet of the same drug thirty minutes preceding the operation, is effective. The indifferent electrode is covered with a towel wet with normal saline solution to make a good contact, and is firmly bandaged against the skin of the abdomen, the patient being in a prone position. Where no general anesthesia is used the active electrode is applied with a very light current which passes around the carbuncle in a circular manner for three to five minutes, during which time the spark is gradually increased. This causes the entire area to become numb. The current is then increased and the needle is pushed to the depth of the infected tissue, where it is allowed to remain. When the tissues become white, the needle is removed and inserted into an adjoining area to produce a similar effect. By repeating this procedure the entire pathologic condition is destroyed in a few minutes. The coagulated tissue is removed by a large curette or by the electrothermic cutting current, leaving a clean base to which a wet dressing of liquor alumini subacetatis, diluted 1:10, is applied. Bleeding points are controlled by plunging the active electrode directly into the vessel or by grasping the vessel with forceps and applying the active electrode to the forceps near the vessel. Pain is not experienced following the treatment because the small terminal nerve endings have been destroyed by the current. Healing may be expedited by the use of ultraviolet therapy, leaving a minimum amount of scarring.

SUMMARY

An incipient boil should be treated early by radiotherapy, which usually aborts the lesion with prompt relief of discomfort and expedites involution without suppuration and without scarring, or by ultraviolet light, one treatment often proving effective. A localized and inactive boil should be freely incised, followed by distance radiation with ultraviolet light to hasten healing. In recurrent and chronic types confined to localized areas, fractional unfiltered or filtered roentgen rays are recommended, with generalized ultraviolet light baths for tonic effects.

In the superficial type of carbuncle either roentgen or ultraviolet therapy causes prompt relief of pain, rapid regression and evacuation of pus. In the deep type, incision is generally the preferable method, supplemented by local and general actinotherapy.

LAME BACK*

Frank R. Ober, m.d.

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LAME back, which is of interest to all medical men, is probably one of the most common ailments of man. Ever since he began to assume the erect position he has been subject to this symptom. During the lapse of time there have been added to the erect posture the diseases of civilization and industry.

It is the purpose of this paper to discuss the more frequent causes of backache, their diagnosis and treatment. Much has been written and taught about backache, but many cases remain baffling and undiagnosed even after all the art and science at our command have been brought to bear on the individual case. Many patients suffer severely from slight causes and contrariwise many suffer slightly from lesions which one would suppose would produce the severest train of symptoms.

ANATOMY AND PHYSIOLOGY

A working knowledge of the structure and function of the spine is necessary in evaluating etiology, diagnosis and treatment. There are three physiological curves: (1) the cervical (anterior), (2) the dorsal or thoracic (posterior), and (3) the lumbar (anterior). Some include the sacrum as a fourth and posterior, but the sacrum properly belongs to the pelvis and is more concerned with pelvic than with spinal movements. Variations in these curves are seen in children where growth is taking place and they are seen also in various disturbances of posture and diseases which affect the spine directly or indirectly. The vertebral bodies articulate with each other, being separated by the intervertebral cartilages, and the processes articulate with each other by the pairs of superior and inferior articular processes. The vertebrae are held together and their movements

checked by ligaments, the chief of which are the anterior and posterior longitudinal. The ligamenta flava connect the laminae of the adjacent vertebrae. The thick supraspinal ligament connects the tips of the spinous processes, the thin interspinal ligament connects the adjacent spinous process from root to tip and the intertransverse ligaments imperfectly connect the transverse processes. The articular processes are surrounded by capsules. The inclination of the pelvis varies with age, posture, and disease, from 44° to 60° in men and from 41° to 65° in women, the average normal inclination being about 50° to 60°.

The movements of the spine are (1) flexion, (2) extension and (3) lateral flexion-rotation. These movements are not actually great in extent, but are apparently so when associated with the free movements of the head, shoulders and pelvis. In general more motion takes place in the cervical and lumbar spines and less in the thoracic; movements in the latter are hampered by the thoracic cage. The movements are carried out and controlled by the free flow of power of the various groups of the muscles extending from the head to the pelvis. Any irritation of the deep structures causes spasm of the neighboring muscles with a resulting diminution of all the normal motions of the spine. In the spine the areas of greatest stress are found where the anterior and posterior curves are joined: first, the cervicodorsal junction, second, the dorsolumbar, and third, the sacral-lumbo; and any extra burden thrown on these areas produces more strain than the anterior and posterior ligaments can well sustain within the limits of their factors of safety. In the pelvis the lumbosacral angle and

the sacroiliac joints are, from their shape and position and the fact that the superincumbent weight of the body is almost wholly borne in this region, subject to much greater stress than the curves above. The iliolumbar and the sacral ligaments are not always sufficient to maintain their integrity against any increase in the angle of inclination of the pelvis, and so become thickened and sometimes calcify.

ETIOLOGY

A classification of the causes of backache should include:

1. Arthritis
2. Trauma
3. Bad attitude
4. Congenital anomalies
5. Malignant disease
6. Pelvis, abdominal and retroperitoneal disturbances
7. Unknown lesions (proliferative, infectious)

1. Arthritis (degenerative) { Disturbances of metabolism / Disturbances of posture

2. Trauma (industry) { Mild trauma, sprains etc. / Attitudes at work / Fractures, transverse processes, compression / Functional neuroses

3. Static or postural condition { So-called epiphysitis / Round shoulders, dorsal or dorsolumbar kyphosis / Lumbar lordosis, potential spondylolisthesis / Functional scoliosis, short leg, low and prominent abdomens / Foot strain

4. Congenital anomalies { Wedge-shaped vertebrae / Extra ribs, rudimentary ribs / Extra lumbar vertebrae / Spondylolisthesis / Sacralized transverse processes / Lumbarized sacral body

5. Malignant disease { Carcinoma of the bone / Sarcoma / Tumors of the cord

6. Diseases of the abdominal viscera { Ptosis / Stomach ulcers / Pelvic organs / Uterus, prostate and bladder / Kidneys

Symptoms. General. Some are common to all the conditions so that it is often difficult and sometimes impossible to diagnose the condition. The patient often gives a history of irregularly recurring attacks of lumbago or pain in the lower back. Pain may be complained of in the small of the back, over one or both sacroiliac joints, over the sacrum and in the region of the coccyx. Sciatica is a symptom which is common to many lame backs, and it is difficult to persuade oneself that it is always due to some irritation in the sacroiliac joints. There may be pain along other nerve trunks, the iliohypogastric, ilioinguinal, superior gluteal, external cutaneous and anterior crural. The back pain may be increased by long standing or stooping. A sneeze may precipitate a violent sciatica. In women, backache may be increased during the menstrual period.

Diagnosis is based on:

History
General physical examination
Examination of the spine
Examination of the extremities
Neurological examination
Carefully taken roentgenograms

History. It is important to get the

history of the onset, number and frequency of attacks, duration and severity of each one, occupation, age, social status, amount of disability, what produces the greatest disability, what the position of comfort is, the location and description of the pain, evidences of infection and the gastro-intestinal story.

Physical Examination. Smith-Petersen[1] has emphasized the importance of a careful and complete examination of the spine and extremities, analyzing each sign and symptom with a view to localizing the lesion producing the discomfort. In the process of securing a careful history and making the examination it is very necessary to size up the mental reactions, stability and attitude of the patient. We should note the attitude in the recumbent, standing and sitting positions, and also the attitude in assuming these positions from one of the others. The gait should be studied noting the lifting function of the lateral trunk muscles, and the position of the legs in standing shoulders, chest, arms and abdomen and back, both from the front and side; note local prominences, measure the circumference of the chest, inflated and deflated. Measure the length and circumference of the legs.

Next it should be noted whether there is muscle spasm, tenderness over the spinous processes, along the ribs, at the iliovertebral angle, over the sacroiliac joints, over the coccyx and the symphysis pubis, along the course of the nerves in the buttocks, abdomen, and thighs. Lateral compression of the pelvis should be done, also a rectal examination.

All the spinal motions should be tested out from the head down in sitting, standing and lying. Straight leg raising of each leg to test for discomfort and of both straight and flexed to discover limitation over the lumbosacral region. Hyperextension of the thighs, singly and together; certain neurological tests should be made especially for disturbances of reflexes and

sensation. And finally a front and side roentgenogram of the spine and pelvis, also a stereoscope of the lumbar and sacral region and pelvis are necessary.

CONSIDERATION OF THE CAUSES

Arthritis. Arthritis of the spine is seen quite frequently. It may occur primarily in the spine or be associated with arthritis in other joints. In many of the so-called primary arthritis cases of the lumbar spine one will often find limitation of lateral flexion of the neck due to arthritic symptoms there. In these cases there is pain in the lumbar region and sometimes in the buttocks and thighs. The lumbar spine is usually flattened, there is more or less limitation of motion and muscle spasm. The change in physiology of the lumbar spine affects all the other curves so that in addition to the arthritic condition we have to deal with the whole spine as a mechanical problem.

In general the treatment involves a thorough search for the cause and in the majority of cases we may locate it either in the teeth, tonsils, sinuses, genitourinary or digestive tract. Chronic constipation, even the mildest grade, is probably responsible for a large percentage of all arthritis. Faulty diet, low metabolism rate and obesity are other contributing factors in the cause.

The treatment is: removal of the cause, regulation of diet and improvement of the metabolism rate.

Trauma. Most of the traumatic backs are seen in the industries and are due to attitudes which the worker must assume at his occupation, whether in the productive or the executive departments. Many sprains and strains are seen because the type of work done constantly subjects the low back to an almost constant strain and stress. There are industrial accidents which produce fractures of the transverse processes or bodies of the vertebrae themselves. The first result from heavy blows or falls in which the patient lands on one buttock tearing off one or more transverse proc-

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[1] Smith-Petersen, M. N. Routine examination of low back cases, etc. *J. Bone & Joint Surg.*, 6: 819, 1924.

esses. The compression fractures result from the patient being crushed from above while sitting or from bad falls when he may land on his feet or buttocks. Such fractures usually take place anywhere from the last dorsal to the sacral region.

The problem of the industrial back is complicated by the insurance, by finding evidences of arthritis in the spine which was symptomless before but now prolongs the original condition because of the irritative injury in the neighborhood of the arthritis; and also there is seen too often an associated functional neurosis giving major symptoms with a minor injury, or due to malingering in order to avoid work and secure compensation.

The so-called railway or functional spine is often seen when there is no money compensation whatever. A diagnosis of functional neurosis is too often made when there is some real pathology present. He who is prone to make a diagnosis of functional neurosis should not do so until he has carefully ruled out all possible pathological causes of backache. Once such diagnosis is made, all the art of medicine must be brought to bear in order to relieve the patient of what to him is a real lesion. Above all the worst advice is to tell the patient that his trouble is imaginary, for then he will not believe and will proceed on a wild hunt for some one to cure him, and the chances are that he will run the gamut of all the cults, cursing and criticizing all doctors for their total ignorance.

Sprains and fractures of the transverse process produce pain, stiffness, limitation of motion, muscle spasm and flattening of the lumbar spine withall their attendant disabilities. In compression fractures there may be no early symptoms whatever, but later on, as bone begins to form, we have many of the symptoms of lame back, and sometimes a small kyphos appears, and a good side roentgenogram will reveal the nature of the trouble.

Static or *Postural Defects.* Under this heading there will be included so-called epiphysitis of the spine which may be local or general and produce a short or a long kyphosis as the case may be. Some roentgenograms of spines representing this condition were shown to the A. O. A. in 1921 by the late R. W. Lovett. Later on Buchman[1] showed some similar plates and called it epiphysitis.

In my opinion this condition is dependent on an incisura of the anterior portion of the bodies of the vertebrae. Attention was first called to it by Engelmann[2] in 1915. Every newborn baby has an incisura. It is a V-shaped depression in the anterior aspect of the spine, filled with soft cartilaginous material. It often persists late into childhood. Superincumbent weight and deficiency diseases may result in a compression of the anterior aspect of each vertebra and the individual bones become wedge-shaped, sometimes elongated anteroposteriorly, the cartilaginous surfaces are roughened in many cases and sometimes there are small wedge-shaped plates on the superior and inferior aspects of each body anteriorly. Later, in adult life, these wedge plates resemble the osteophytes of arthritis. A great many of these patients develop very stiff round shoulders.

Round Shoulders. Round shoulders are also due to bad attitudes, and the lumbar curves may be increased so much that the angle of inclination of the pelvis is nearer 90° than the normal 50° or 60°. This results in a tremendous strain at the lumbosacral junction, producing considerable pain and discomfort. The pain is usually localized in the sacrum, both sacroiliac joints, or at the lumbosacral junction. All motions may be free. Low and prominent abdomens produce similar conditions, but the thorax is more apt to be held back over the pelvis so that the chest is posterior to a central perpendicular line through the pelvis.

Functional Scoliosis. Functional scoliosis may be a cause of backache especially

[1] Buchman, J. Vertebral apiphysitis; cause of spinal deformity. *J. Bone & Joint Surg.*, 7:814, 1925.

[2] Engelmann, G. Zur Aetiologie der habituellen Skoliose. *Ztschr. f. Orthop. Chir.*, 35: 256, 1915.

located in the sacroiliac joints. It is usually due to a short leg or to the pelvis not being level from some anatomical inequality. The result is a total curve of the spine to the left in 90 per cent of the cases. Such a curve from its leverage can produce symptoms of lumbosacral or sacroiliac strain.

Congenital Anomalies. Wedge-shaped vertebrae cause scoliosis and may produce low back pain. Rudimentary ribs in the low lumbar region are short and may be a source of irritation after injury, so also may extra ribs on the first lumbar, especially when unilateral. Spondylolisthesis is a dislocation forward of a vertebra and is usually seen at the fifth lumbar. It may be due to injury or it may be congenital in origin and is caused by a failure of union between the pedicles and the laminae. This condition causes low back pain and sciatica, and limitation of motion. The sacrum is very prominent, the buttocks seem high, the waist line short, and there is usually a transverse sulcus in the soft parts at the waist line.

Sacralized transverse process is a projection downward to the ilium or sacrum of the transverse process of the fifth lumbar. The size of the process varies; sometimes it is so large as to take the place of one-fourth of the upper part of the wing of the sacrum. Injuries of the low back may irritate the articulation of the sacralized process and give rise to limitation of motion, muscle spasm, sciatica and backache. The sciatica may be present on the side opposite to the lesion.

Lumbarized sacral body is not very common, but when present it increases the liability to back strain as also do sixth lumbar vertebrae, because the waist line is lengthened and it becomes correspondingly difficult for patients with these anomalies to stand the stresses of posture and occupation.

Too often, no doubt, backaches are ascribed to the discovery of some congenital malformation, as it is convenient to have something abnormal present with which to satisfy ourselves in making a diagnosis. We should remember that many of these patients have had their anomalies all their lives, but not all of them have had backaches all their lives.

Malignant Disease. Malignant disease of the spine is not very common, but it is seen often enough and missed many times because the examination has not been complete. These patients suffer a great deal of pain in the region of the growth and may develop cord symptoms. The diagnosis is usually made by the roentgen ray. A search for the primary lesion should be made in order to confirm the diagnosis, unless the source is already known. Tumors in the spinal cord often produce vague symptoms of backache; here a neurological examination is necessary and also injection of lipiodol will help.

Diseases of the Abdominal Viscera. Ptosis, ulcer and cancer of the stomach, diseases of the uterus or prostate and stone in the kidney, ureters and bladder may cause pain in the back and should be ruled out.

TREATMENT OF LAME BACK

Severe Cases With Sciatica. Unless one can actually demonstrate pathology of the sacroiliac joint, treatment consists of rest in bed with the back strapped or a tight swathe applied. Occasionally a plaster spica is necessary to relieve the sciatica. Patients learn instinctively to tuck pillows under their knees and lumbar spine in securing relief. Many patients wake up in the middle of the night and find that they cannot go to sleep again. I advise them to get out of bed and sit in a chair for half an hour or so, reading or smoking. On returning to bed they nearly always fall asleep. Some of the very severe cases require codeia or morphine to relieve the intense pain. I have never found a plaster jacket of the slightest use. Most of the lame backs are flat and one of the first indications of relief is a return of the lum-

bar spine toward the normal physiological curve, and any apparatus to maintain relief must be altered to fit this curve. In other words we treat irritable bodies in the line of deformity just as we do hips and knees after the patients get out of bed. In the ambulatory cases a cloth and steel corset is applied. It is so constructed that it fits the lumbar region and buttocks closely. The cloth is cut in such a way that the crests of the ilium are not pressed upon (if they are the corset will ride out of place and then the hold on the abdomen will be lost, thus throwing more load on the spine and the whole body out of balance). This type of corset can be adjusted to suit the changes which occur in the spine due to improvement. In some of the bad ambulatory cases a Taylor back brace is necessary for a short time.

Arthritis may be treated by rest in bed; if very acute, later a well-fitting corset or brace may be applied until the local symptoms disappear. One should not be content with orthopedic measures alone. The dead tooth or infected tonsil should be removed, the diseased sinus properly drained. The intestinal case should have a proper diet, constipation must be relieved, and this is best done in arthritis by the use of some of the oil preparations. Agar-agar may be added. Intestinal massage and irrigations relieve a great many of these patients.

Postural defects are best relieved by support and developmental exercises. If a functional curve is present it may be corrected by wearing a lift in the heel of the shoe. This simple device has relieved many low backaches and so-called sacro-iliac strains. The low and prominent abdomen should be supported by a properly fitted corset.

Foot strain is a source of backache and is usually seen in the highly arched foot with loss or shortness of passive dorsal flexion when the knee is extended. In this type of foot all the posterior leg muscles are short and when the load becomes too great for the feet as a result of either illness or overweight, the patient instinctively assumes bad attitudes to relieve his condition. This condition is best treated by raising the heels temporarily, the use of steel plates in bad cases, and raising the shank of the shoe in mild cases.

Leaving off the support to be decided for the patient. All the signs and symptoms of lame back may have disappeared, but to my mind it is not safe to remove the supporting apparatus, chiefly because there has been severe muscle atrophy as a result of disease and splinting. It would therefore seem necessary to give the patient some exercises to develop all the muscles which support the spine and maintain the erect position. These include the back and abdominal muscles, also the thigh muscles, especially the gluteus maximus. One may properly begin such exercises very gingerly when the patient is able to arch his spine in the forward bent position.

Operative treatment does not apply to arthritis except with tuberculosis. In general, operations should not be done on the spine until all other measures for relief have been exhausted. In traumata, sprains, strains, and fractures of the transverse process, get well with rest, support, strapping, etc. Most compression fractures do well if kept in bed eight to ten weeks, using a plaster or leather jacket, followed by a Taylor back brace for a year or two. A few compression fractures give rise to persistent pain as a result of non-healing of associated features of the laminae or spinous processes. Fusion of the spine should be done under such circumstances.

Sacroiliac Joint Disease. Osteomyelitis and tuberculosis of this joint are best relieved by some form of fusion operation.

Congenital Anomalies. Braces or corsets will relieve most cases. Occasionally the disability from spondylolisthesis and sacralized transverse process is so great that operative treatment is indicated, and a fusion of the spine after Hibbs' or Albee's method gives the best results.

Malignant disease of course is hopeless. These cases may be given deep roentgen-ray therapy and the pain should be relieved by whatever orthopedic and medical measures we have at hand.

Diseases of the abdominal viscera are surgical problems.

SUMMARY

1. The diagnosis of lame backs still belongs to the art of medicine from the point of view of diagnosis. The roentgenogram is a valuable aid when it will demonstrate pathology.

2. In making a diagnosis even the slightest symptoms may be of the greatest importance.

3. It is very difficult with our present knowledge to determine in every case the location of the lesion in the early stages.

4. Traumatic neurosis is a diagnosis easily made but hard to prove.

5. One should not approach a lame back with a preconceived or snap diagnosis.

6. Treatment is based on fundamental principles of rest and protection followed by proper physiotherapeutic measures to effect a cure.

7. Unless malignant, the prognosis in practically every case is good.

EVERYDAY OCULAR INJURIES*

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INTRODUCTION

THE impact of a foreign body against the cornea usually causes immediate pain which is soon accompanied by blepharospasm, increased lacrimation and photophobia. These symptoms arise from injury to the sensory nerves of the cornea directly, or indirectly through reflexes excited by the injury. Occasionally a wound can be demonstrated objectively when it is not accompanied by symptoms because the sensitive nerve terminals have been destroyed or obtunded. Those cases in which unimbedded foreign substances can be removed with a cotton-wound probe will not be considered.

Foreign bodies commonly consist of detached bits of cinder, coal, emery, grains of gunpowder, metal, stone, glass or wood chips. Leaves, twigs, thorns, wheat beards and so forth also can injure the eye. Before proceeding with an examination valuable information may be obtained by inquiring into the patient's occupation and environment at the time of the accident.

EXAMINATION

The examination is made first in good daylight and then under bright artificial light. The eyelids are separated and the patient is made to look in different directions, as the examiner desires, until all of the cornea has been scrutinized; the use of a condensing lens, loupe, or magnifying glass is advantageous. A foreign body may be located with the ophthalmoscope by using convex 7, 16 or 20 lenses at appropriate distances with the illuminated pupil as a background. The next step is to stain the cornea, not only to locate the wound but to determine its extent and depth. A few drops of 5 per cent cocaine solution are instilled, and then a solution of fluoresceine, 2 per cent, combined with sodium carbonate, 4 per cent. After waiting a few minutes the eye is irrigated with boric acid or normal salt solution. A bright green color appears at the site of any recent destruction of corneal epithelium. A circumscribed dark spot in a field of green indicates the position of a foreign body if present; perforating injuries do not exhibit a dark spot.

Photophobia or pain make it difficult or impossible for the patient to keep the lids separated. A few drops of 5 per cent solution of cocaine or butyn in the conjunctival sac generally reduces the disability. A blepharospasm that does not yield to this expedient can be relaxed by injecting 1 or 2 c.c. (16 to 31 drops) of 2 per cent solution of procaine, with or without 0.016 gm. (¼ grain) of morphine sulphate, into the tissues outside the lateral border of the orbit; the injections are made deeply toward the external auditory meatus and the ramus of the mandible. This paralyzes important branches of the facial nerve. The eye should be protected by dressings for at least six hours after the use of any local or infiltration anesthetic. General anesthesia is advised for the examination and treatment of small children.

TREATMENT

The removal of a foreign body should be undertaken only with adequate illumination, effective anesthesia and *aseptic precautions*. A few drops of 40 per cent argyrol solution are instilled into the conjunctival sac and the sac is then irrigated with sterile normal salt solution, or mercurophen 1:8000. The lids can be held apart with retractors or an eye speculum. Magnification may be required as for the examination. Normal salt

solution should be dropped on the cornea frequently to prevent drying of its epithelium. The patient is instructed to fix the gaze on some selected object with *both eyes open*, in order that the eyeball shall be steady in position; a drop of cocaine solution in the uninjured eye is helpful.

Magnetizable substances may be removed with an eye magnet; where they are obstinate the current should be made and broken rapidly to create *jerking* pulls. The removal of small foreign bodies from the cornea may be attempted with an eye spud or needle, or the sharp point of a fine knife, such as a cataract knife. The instrument is worked around and under the body, which is then lifted out. Glass is especially difficult because of its transparency. Powder grains are usually numerous and tedious to dislodge. Iron often leaves a rust stain which may be removed with a fine dental drill rotated by the operator's fingers.

A foreign substance free in the anterior chamber is removed by opening the chamber at the periphery and grasping the body with fine forceps. Where the body is lodged in the iris both are grasped with forceps and drawn out only far enough to permit excision of the part of the iris which contains the body. The lens must not be touched. These surgical wounds do not require sutures, but they should be dressed daily until the anterior chamber has fully reformed.

Patients with foreign bodies situated posterior to the iris should be referred. Foreign bodies in the lens are prone to cause cataract; those in the ciliary body usually cause violent iridocyclitis and those in the posterior segment of the eye are removed only with great difficulty even by experienced operators.

An object can perforate the cornea without remaining in the eye. Flaps are fashioned from the conjunctiva to cover the opening until the cornea shall have been healed and any leakage of aqueous stopped. The conjunctiva is incised 1 mm. from the cornea for about half of its circumference.

The flap is formed by undermining the membrane, drawing it over the perforation like an apron and suturing it at each side

Fig. 1.
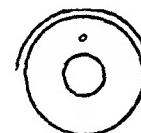
Fig. 2.
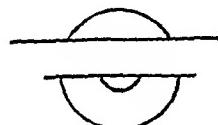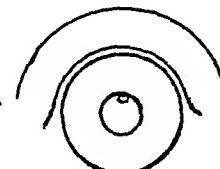
of the cornea with fine silk (Fig. 1). If the perforation is central it is better to fashion a double pedunculated flap. The first incision is made as in the former instance and another concentric with it and 5 or 6 mm. more peripherally. The flap is undermined, brought over the wound and fixed in place by sutures outside the cornea (Fig. 2). No suture or loose ends should lie in contact with corneal tissue. Ordinarily the sutures can be removed in five days.

A neglected foreign body in the cornea may be overgrown with epithelium and become encysted. If infection is present an abscess will form; it should be incised promptly, cleansed by gentle irrigation, *dried* and then painted lightly with pure phenol. Otherwise the abscess may rupture and perhaps expel the body or it may lead to loss of the globe. Cases of intraocular infection should be referred.

BURNS

Burns are caused by boiling liquids, steam, acids, alkalies, lime, flame, curling irons and splashes of molten metal. Anesthesia is required as for foreign bodies. All particles of alkali, lime or metal must be removed from the cornea and conjunctival sac. Lime tends to produce permanent opacities in the cornea; these cases are treated by removing the particles with forceps, sponges and irrigations with freshly prepared 2 per cent aqueous solutions of neutral ammonium tartrate or

ammonium chlorid. These irrigations may have to be repeated daily or oftener for some time. The solution of the tartrate should be gradually increased in strength up to 20 per cent if tolerated.

Small losses of conjunctiva can be repaired early with grafts of mucous membrane cut from the inner surface of a lip, but in the case of alkali, metal or other deep burns the flap will probably be lost by sloughing unless its application is postponed until the inflammation shall have subsided. In burns involving the conjunctiva of the lids and the cornea flat pledgets of cotton impregnated with bichloride ointment should be placed between the two structures as deeply as the wound extends into the cul-de-sac to prevent the formation of a symblepharon.

Ether may enter the eye accidentally during its administration for anesthesia; it causes a painful but superficial lesion. Phenacaine ointment and bandage are applied as often as necessary to control pain.

DRESSINGS AND AFTER CARE

At the conclusion of the initial treatment for foreign bodies or burns the conjunctival sac should be irrigated with a solution of mercurophen or mercuric chloride 1:8000. A drop of 1 per cent solution of atropine is instilled; a drop of 1 per cent solution of phenacaine hydrochloride (holocaine) may be added. Ointment of 1:3000 mercuric chloride, made up with petrolatum and lanolin as a base, is placed beneath the lids and the closed lids are covered with an eye-pad or bandage. The patient may be supplied with a solution of phenacaine for pain and some bichloride ointment for dressings. Instructions are given about proper care, the liability of infection and its consequences, and the reasons for reporting promptly should the eye become red or painful. In mild cases the dressings may be discontinued after twenty-four hours. Severe cases require further attention. Painful wounds sometimes need dionine in 5 or 10 per cent solution or ointment two or three times a day. Phenacaine may be combined with the dionine.

Some apparently healed corneal wounds are characterized by instability of the new epithelium. When the patient opens the eyes on awaking, the lids scrape off the new cells and pain of a few hours' duration ensues. Such eyes should be dressed with 5 per cent dionine ointment or 2 per cent yellow oxide of mercury ointment at bedtime. White opacities occasionally remain in the cornea after healing has been accomplished; in recent cases 10 per cent dionine and light massage daily are often of benefit in helping to restore transparency.

CONTUSIONS

Contusions of the eyeball are frequently followed by an edema of the cornea with clouding which may resemble an interstitial keratitis. The history of injury, prompt appearance of the opacity and an early recovery will be of help in making the differentiation. Sometimes an attack of true interstitial keratitis is precipitated by a contusion in congenitally syphilitic patients; unilaterality is characteristic of this condition. The treatment of contusions is by cold compresses for ten minutes every two hours, dionine in 5 per cent solution or ointment twice daily and light massage once daily. Whenever the cornea is insensitive the eye should be protected with ointment and bandage.

Hemorrhages sometimes occur into the anterior chamber after trauma. The coloring matter of the blood may stain the cornea; clearing begins at the periphery, but the restoration of transparency is greatly delayed and often incomplete.

THE SIGNIFICANCE OF THE
INFLAMMATORY REACTION
FOR SURGERY*

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MC GREGOR, MINN.

OUR knowledge of the field of the inflammatory reaction is still vague and unorganized. There is scarcely a branch of the natural sciences in which so many varying opinions can be found as to the significance, function and use of the inflammatory reaction.

In the following pages an attempt is made to emphasize some important points in the general knowledge of this topic, to add some new ideas on the subject, and to set forth systematically the significance of the inflammatory process for surgery. Only the necessary facts on the subject of inflammation are cited, and details of morphology and specific processes are omitted.

I am taking the liberty of adding to the literature on this subject because of the fact that in the last four years I have carried out many hundreds of experiments on men and on dogs. The object of these experiments was to change fat and connective tissue into reacting tissue, resembling granulation tissue. This was attempted by injections of chemical substances or by other means associated with the least amount of tissue damage. It is quite probable that such tissue (that is, granulation tissue), rich as it is in blood vessels and young plasma cells, can be utilized for its effect upon infections, the healing of wounds, and other therapeutic purposes. Details of the experiments and bibliographical references are given in previous publications.[1] The present article

purposes merely to draw a broad picture of inflammation as revealed in the cited experiments, without giving the detailed protocols.

Inflammation may be defined as an active local reaction on the part of the tissues. The practitioner sees this phenomenon usually as the result of bacterial infection. It has been well known for forty years, however, that exactly the same type of inflammatory reaction can be produced in other ways, as are caused by burns, chemicals, rays, operations, etc. A sterile cell destruction brought about, for instance, by the injection of a hypertonic salt solution, can produce the same clinical picture as a streptococcus phlegmon. In spite of this even the best and most recent authors use infection and inflammation as synonymous terms. In this article these two terms are differentiated. The active rôle of bacteria and their power of multiplication and dissemination in infection are of secondary importance compared to the tissue destruction caused by them. This point of view is justified by the similarity existing between the inflammatory processes effected through bacteria and through the tissue destruction resulting from chemicals.

The real key to the understanding of inflammation is the knowledge of the relation between inflammatory reaction and tissue destruction or impairment. There is doubtless a relation between the two, but it is meaningless to explain the inflammatory reaction as the result of tissue impairment. It is quite apparent that often the extent of tissue destruction is in no proportion to the degree of reaction.

We see for instance, in the case of a

[1] Strauch, C. B. Ueber die klinischen Grundlagen einer lokalen Reiztherapie. Arch. f. klin. Chir., 145:42, 1927.

Ueber Reizstoffe und ihre Wirkung im Hinblick auf eine lokale chemische Reiztherapie. Arch. f. klin. Chir., 146: 97, 1927.

severe traumatic crushing of an entire extremity with extensive tissue destruction, that the inflammation sets in much later, and that it occurs for the most part in places where there are no skin lesions that might prevent or diminish the resorption of broken-down tissue elements. Even should extensive areas become infected, the inflammatory reaction may be minimum if abscesses or phlegmons, that is, bacterial foci within the tissues, do not develop. Nor is there necessarily a direct ratio between a necrosis and the accompanying development of an inflammation as is proven by the customarily small inflammation around embolic infarcts, or, at the border of a bland mummification of an extremity caused by injuries, to the vessels. In such cases, when we assume that a certain invasion of the intact tissue by substances of decay takes place, a moderate demarcating reaction develops slowly. Even in local infection the inflammation is not proportioned to the damage of the tissues. A typical case of panaritium starting with a subcutaneous, yellowish, discolored, small focus on a finger, discloses that the entire arm is edematous, reddened and showing flame-like streaks of lymphatics leading to enlarged axillary lymph nodes. A surgical incision now adds further damage to the infected area and after a few hours the bacteria have spread throughout the entire wound, but the inflammatory reaction, up to the nodes in the axilla, has almost disappeared.

In this case, too, the degree of inflammation can be better compared with the extent of the resorption from the diseased focus than with the amount of tissue destruction. Such examples can be cited ad infinitum. Every surgeon knows that where he deals with prolonged signs of an acute inflammation (redness, swelling, etc.) he has to do either with a diffuse spread of toxin-producing bacteria such as erysipelas or phlegmons, or with a local, limited, for the most part suppurative and bacterial focus, which loses its inflammatory characteristics soon after being opened.

These few examples suffice to demonstrate the function of the inflammatory reaction as "the attempt of the surrounding tissue to prevent the resorption of elements of tissue destruction and of the assembling of bacteria. The rôle of tissue impairment, aside from the fact that it is the nidus of the infection, is merely that of a depot from which a prolonged flow of destroyed tissue elements takes place. An inflammation will be caused in all parts of the body where a parenteral absorption of certain materials takes place, especially if the substances absorbed are albumins and toxins. The extent and the duration of the inflammation agree with the area of resorption and its duration. It is not the damaged areas which suddenly acquire an increased functional ability, but rather the dormant, intact forces of the surrounding tissue which react to the invasion of certain substances not belonging to the highly specialized albumin structure of the body. The sensitiveness of the nerve endings and of the capillaries may serve in the same manner after parenteral invasion as do taste and smell at the portal of oral supply, and have warning and controlling functions.

Each inflammation reaches maturity with the formation of granulation tissue. This granulation tissue may be found on the body surface, the floor of ulcers, in wounds healing by second intention, in opened abscesses, etc., or it may consist of tissue infiltration. The granulation tissue, rich in protoplasm, and aided by the plentiful blood supply, is the means by which the body creates what may be regarded as a new skin which acts as a bar against the parenteral resorption of foreign elements. It is well known that a wound daily acquires greater resistance to injury, so that after from three to seven days the granulating surface acts almost as well as healthy mucous membrane or as skin in respect of impermeability. New formation and growth require time and it is for that reason that the formation of regular granulation tissue is to be looked

for only where resorption has lasted a sufficiently long period.

In the course of granulation tissue formation the single components of the inflammation complex working constantly together have a practical subfunction. Edema probably has the purpose of diluting and resorbing substances destructive to the tissues. Purely fibrinous exudate is known to act as a speedy encapsulator. The pus cells are of importance mainly as carriers of protein solvent ferments. Necroses, foci of infection and many chemical substances, particularly plant albumins, attract them, leading to abscess formation. The phagocytic function is to be regarded as relatively unimportant when one takes into consideration the prolonged presence of bacteria in empyemas and the ease with which tubercular and chemically produced abscesses can be infected secondarily. These three phases of the inflammatory mechanism can be stimulated quickly, whereas the work done by the granulation tissue is slower but more effective. The pus cells are capable of advancing as far as the focus of infection, there to counteract it.

A comprehensive survey of all experiences up to the present and my extensive experiments with more than one hundred substances of various kinds, give no indication as to how an "optimal," purely reactive tissue change can be produced with any one of the known substances at hand. All substances producing marked inflammatory reactions did not produce a primary inflammation. They only destroyed the tissue and the gradual and continuous dissemination of the tissue proteins into the adjoining tissues, and the lymphatic system effected the inflammatory barrier. The substances originally injected, if they are not at once made ineffective by necrosis, are resorbed long before the inflammation sets in and continues. Substances causing decided inflammation, like Croton oil, turpentine, salvarsan, cantharidin, etc., are merely substances having the property of marked tissue destruction.

At first it was surprising to find after injection of such substances extensive necrosis and cavities surrounded by only a small reactive zone.

We have in addition to the tissue damage in a case of local infection the continual discharge and absorption of bacterial proteins and toxins. A very limited tissue damage, such as the core of a furuncle, may for a long time maintain an inflammation through the steady production of the substances that nurture it. Renewed tissue damage is not necessary.

An inert substance producing a mild but continuous effect upon the surrounding tissue through the slow solution or discharge of its elements, which can be implanted into the tissue, should be able to produce and maintain an inflammatory reaction with but little or no tissue destruction. Such pure reactions can be brought about with substances resorbed with difficulty, such as oils, fats, waxes, paraffins, iodoform, agar-agar, kaolin, etc. It is questionable, however, if one assigns to the protein substances the special rôle of producing inflammation, whether the thus created, relatively small and slowly developing tissue reactions do not belong rather in the realm of formative irritation.

Together with Dr. H. Bernhardt, University of Berlin, I have worked out a method which permits the slow resorption of any water-soluble substance once it is injected. Up to the present this method has proven practical and successful only in the application of such drugs as insulin, adrenalin, strychnine, etc.

Inflammation was defined as the attempt to prevent resorption. The meaning of this is that tissue able to react is not always successful in doing so. Fever, which is the general reaction of the organism in the same direction, is a measure of the substances that have gained admission into the circulation in spite of the inflammation. It is known that it is mainly the mobilized or introduced protein substances that cause the reaction. These protein substances also represent the most important

antigen for the third great reaction (the specific one).

The degree of the fever reaction as well as the extent of the inflammatory process is determined, on the one hand, by the degree of toxicity of the products and on the other hand by the amount of pressure with which they are diffused into the tracts of resorption. The old therapeutic postulate of pressure relaxation of infected foci by means of broad incision agrees with the conception of inflammation emphasized here. Every inflammation with the distinct signs of redness, heat, swelling and pain, is a proof that foreign protein substances are absorbed under pressure. A release of pressure through incision is therefore always indicated except in some special instances (such as gonorrhea, tuberculosis, etc.). Pus will be found if the focus has attracted a sufficient number of leucocytes. The incision, however, also releases the pressure of a phlegmonous focus before suppuration sets in. The protective power of the inflammatory barrier is generally great enough to prevent continued damage and further absorption of infective elements from open and shallow wounds.

We have seen that the inflammatory reaction plays an important protective rôle in the protein economy of the body and that its components, such as edema, fibrin, pus and its ultimate aim, the formation of granulation tissue, have each their important special functions. The continual, doubtful interchange of the terms infection and inflammation is probably responsible for the fact that, except in a few cases, no attempt has been made to utilize the possibilities in this field therapeutically. The poison-diluting action of the edema is similar to the infiltration of the tissues with physiologic salt solution

after accidental paravenous salvarsan injection. The treatment of wounds containing tendon or bone necroses with leucotactic substances or proteolytic ferments is probably aided by the dissolving action of pus.

The production of tissue is closely allied to inflammation. We often observe that a prolonged, mild infection of bones produces changes which we would be glad to bring about if this could be done in a well-regulated and harmless manner in cases of poorly healing fractures, in pseudo-arthroses, in stiffening joints and lengthening of bones. Suggestions of other therapeutic possibilities which can be derived from infections are: Metaplastic bone formation in the tissues, acceleration of healing of wounds, softening of scars and creation of supporting tissue; increase of resistance of the tissues and eventually influence upon chronic infections, new growths, etc. We follow the same principle when we produce a venous thrombosis in varicose veins by injections or stimulate slowly healing epithelium with scarlet-red ointment and the growth of granulation tissue by means of other substances long in use.

For the present surgery must be satisfied with the use of purely mechanical means since it is not able to make plastic, functional and formative impressions upon its fundamental working material, the supporting, connective and vascular tissue. The three great reactions of the organism are: (1) specific defense (antibodies, etc.), (2) systemic reaction (fever, leucocytosis, etc.), (3) local reaction (inflammatory and productive processes). Since the first two are utilized successfully in so many therapeutic ways it is to be expected that future therapy will also be enriched by the third reaction.

PRURITUS ANI

VS. THE GENERAL PRACTITIONER*

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THERE are many situations which the general practitioner meets that remind him of that popular cartoon "When a Feller Needs a Friend," but there is probably none in which that phrase more aptly applies than in the instance of an inveterate case of pruritus ani. Textbook suggestions and a host of pet prescriptions come to naught when brought face to face with this very trying clinical problem, a problem that is as trying to the physician as it is to the unfortunate sufferer. Indeed many a hard-earned reputation of being a thoroughly up-to-date doctor has been dashed to splinters on this clinical reef.

A recital of the symptoms of this malady is hardly necessary in a practical paper such as this, particularly since that of itching dominates all others, an itching that seems in its selection of those hours ordinarily reserved for rest for its agonizing antics to be imbued with personal malice. Weary with the day's labor the patient retires for well-earned slumber but almost as soon as he has become thoroughly comfortable the petulant torture of itching descends upon him. To obtain relief prolonged and unreasonably vigorous scratching is indulged in and such a procedure only results in abrasions which in turn are irritable, become infected and give rise to further itching.

I have pictured these circumstances no more darkly than they actually occur, and while it is true that I have painted a severe case, I do so in order to impress upon the reader the seriousness of the situation when considered from the patient's standpoint and also to overcome, if possible, the regrettable levity with which the situation is viewed by many of our confreres. Let us agree, therefore, that it is a serious state of affairs and one that cannot, with justice to the patient, be lightly dismissed with a smirk and a stock prescription.

Every case of pruritus ani is definitely curable. Every case is entitled to be cured. As to exactly how this may be accomplished in any particular case may best be decided after reading the following suggestions. They are made on the basis of what I believe to be a rather extensive and intensive experience with pruritus ani. Since the publication of my book entitled "Pruritus of the Perineum" I have seen and treated 391 cases of pruritus ani; of these I have had reliable reports from 349. The experience acquired as a result of handling pruritus cases in such numbers is serving me well as a guide in my present handling of that type of ailment and it is this experience which I feel may be found of real practical guidance to others.

The things one should *not* do in a case of pruritus ani are to my mind of even greater importance than those one should do. Certainly it will be agreed that if we cannot help the unfortunate sufferer we can at least refrain from doing him an injustice or actual harm. As a specific instance of the latter there come to my mind a more than moderate number of bad results in cases that have previously been treated with roentgen-rays. From such a case may the clinical gods deliver us! In place of or in addition to, the skin condition of pruritus we have a roentgen-ray burn which is as difficult to heal as it is easy to acquire.

No one will deny that there are cases of pruritus which are apparently relieved by roentgen-ray treatments; however, it

* Submitted for publication February 25, 1929.

should *not* be denied that many cases are not relieved and some are actually aggravated, while others are burned in the zeal to obtain results. These observations prompt my first negative suggestion: do not use roentgen-rays in the treatment of pruritus. We know too little about the action of roentgen-rays and its possible relation to cancer origin to employ indiscriminately an agent whose effects we cannot control.

Ultraviolet or quartz light therapy, though by no means as dangerous as roentgen-ray therapy, does often result in an aggravation and apparent extension of the pruritus.

Prolonged use of ointments containing carbolic acid also carries with it unpleasant possibilities. So, too, does the use of belladonna ointment and cocaine suppositories. Opium suppositories and morphine particularly should be avoided in pruritus cases, partly because of the danger of habit formation when used in so chronic an ailment, and partly because of the specific property of these drugs themselves to cause itching. This may often be observed in cases given morphine for other reasons. The itching nares and sometimes generalized itching which accompanies the uses of this drug is alone sufficient reason to exclude it in the treatment of pruritus ani.

Shaving the parts is often done in an endeavor to aid in local cleanliness and to permit the more direct application of ointments. My own experience has been directly contrary to that which holds shaving to be an advantage. I have found that when the root hairs proceed to grow, as they do in a few days, they are so bristle-like that by their very presence they irritate the skin on the opposite side of the perianal region. This incites further itching and scratching with definite aggravation rather than relief.

Aside from all the above negative suggestions I believe we should realize the gross injustice of proceeding to any form of treatment in pruritus cases without a preliminary examination, not only of the perianal region, but of the entire anal canal, rectum and sigmoid.

Moreover, I believe that every case is entitled to a thorough complete physical examination. This surely should include urinanalysis and possibly a blood chemistry examination. In this way we will avoid the embarrassment of discovering that we have been wasting perfectly good roentgen-ray skin doses on a case of carcinoma of the rectum which we might better have recognized and treated as such instead of its associated symptom of pruritus. Nor will we treat cases of diabetes with some ridiculous unguentum while neglecting general treatment.

As a definite plan for approaching the problem of treating any specific case of pruritus ani I have adopted the following routine as a guide. It is varied according to the requirements of the individual cases but at least it has an advantage of guiding one's observations and endeavors along rational lines. One of the first questions which I ask a patient suffering from pruritus ani is whether he has itching on any other part of his body. In this way my attention is brought to those cases which at the outset are known to be of more than local concern. I then ask the patient what itching disease he has had in order to establish any tendency toward food allergy. Next I ask the patient what treatment he has already had for this condition. I believe it will be readily understood that the latter is an important question since I have seen cases in which carbolic acid burns were big factors in the clinical problem presented. The same applies to the matter of roentgen-ray burns. In the face of this and similar obstacles to treatment one should be in the full possession of the facts. Another question upon which the patient can give help is the matter of his diet. Where this has been particularly flagrant in its departure from reasonable food demands we are furnished with a clue as to possible intestinal causes for his disorder.

Following these questions and what other questions seem pertinent to the problem, I proceed to a thorough examination of the perianal skin for local causes. As to exactly what these may be I suggest a perusal of my monograph "Pruritus of the Perineum."

Aside from the matter of a thorough rectosigmoidoscopic and general examination, which incidentally I consider the first step in the matter of treatment, there are three other steps to be taken. Foremost among these is that of immediate relief and for this immediate relief one should certainly not employ morphine or other habit-forming drugs. We should employ some procedure which will give relief not only during the sleeping hours, but also during the waking hours of the patient. There is no drug which can quickly and completely give this relief without harming the patient. There is, however, a procedure known as the undercutting operation which can be employed without jeopardizing the patient's general condition.

The undercutting operation is a very simple procedure which consists of the severing of the sensory nerves immediately under the skin in the perianal region. This is done by means of a special pair of scissors shown in Figure 1, through small incisions as indicated in Figure 2. It is an extremely simple procedure and may be done under local anesthesia in ten minutes or less. The rationale for the employment of this operation is as follows:

Itching causes scratching and this scratching damages the skin. In the repair of this damage, fibrosis of the papillary layer of the corium occurs and in the inevitable contraction of this newly formed fibrous tissue the sensory nerve endings in this area are compressed. Compression gives rise to a stream of irritant stimuli which in consciousness are recognized as itching. The itching naturally gives rise to a further desire to scratch. We have, therefore, a vicious circle as follows: Itching causes scratching: scratching indirectly causes fibrosis and this in turn by

compressing the nerve endings causes increased itching. Now, therefore, if we break this vicious circle by severing the
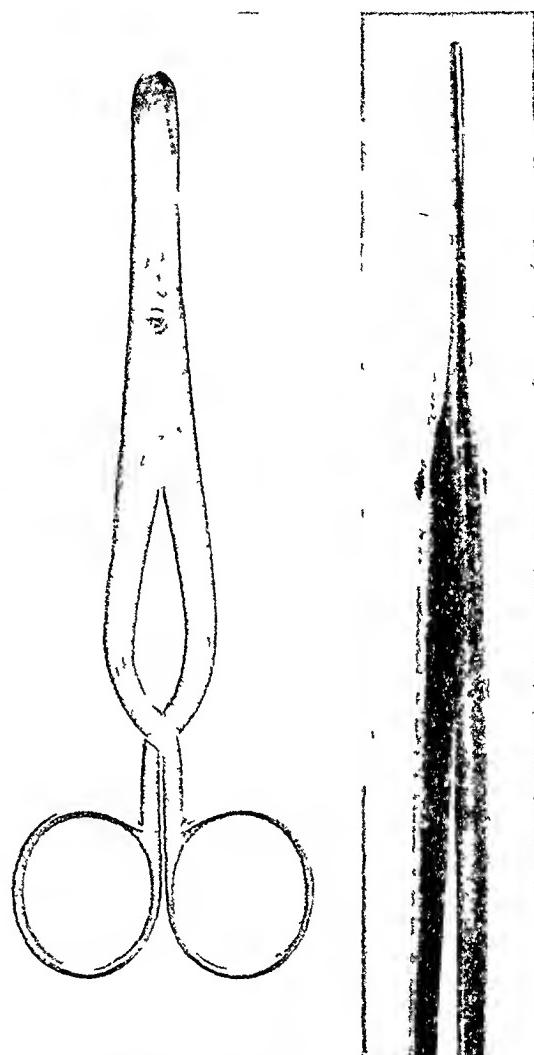
Fig 1   Double-edged dissecting scissors for use in undercutting operation.

nerve endings we allow the skin sufficient sensory rest to accomplish healing. The operation is only part of the cure and its main object is to allow the correction of the skin damage done and to prevent the occurrence of further skin damage.

In early cases in an attempt to avoid this operation the skin in the pruritic area may be treated by cauterizing the exposed sensory nerve endings. This is for the reason that when excoriation occurs the minute filaments of the sensory nerve endings are exposed to the air, to the action of mucus and other secretions. The irri-

tation which naturally results from such an abnormal state of affairs gives rise to an increased desire to scratch. To avoid the establishment of what thus threatens to be a vicious circle, such an area should be cauterized with a 10 per cent aqueous solution of silver nitrate. Such cauterization is of great temporary value and if supplemented by protective ointments will do much to avoid further skin changes.
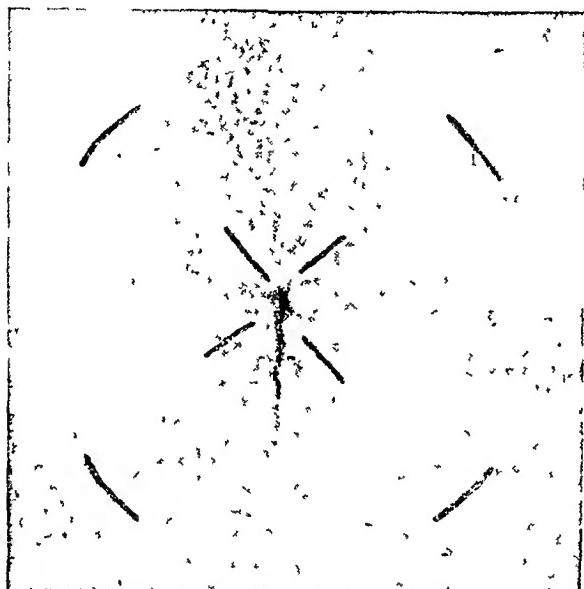
FIG 2 Position and extent of incisions in undercutting operation

The object of protective ointments is to exclude air and particularly water from the exposed sensory nerve endings just mentioned. Almost any bland ointment is as good as another for this purpose. Vaseline, boric ointment, zinc oxide ointment made from lanolin or Lassar's paste are those which I most commonly use for this purpose. Mild protective ointments such as the foregoing will be found much more satisfactory than the anesthetic ointments since the latter are exceedingly prone to become intolerable to the skin.

The employment of vaccines has been suggested for many years and while the method has had its deterrents, I myself have had gratifying results from the sensible employment of vaccines. By the sensible employment of vaccines, I mean the utilization of those vaccines which may reasonably be supposed to be capable of exerting beneficent influence and moreover the use of these with a full understanding of what they are intended for and, what is more to the point, what they are not intended for. As an example of the latter I might mention that vaccines employed in pruritus ani are not intended as a means of removing primary causes such as local pathology or visceral disease. Their one and only purpose is to raise immune resistance to those organisms which have been demonstrated to be actual invaders. The vaccine I use is pruritus vaccine, Lederle. I have used it in the previously mentioned series of cases and believe it has done much to minimize the low-grade dermal infection which is always a possibility in these cases.

It will be noted that in all the foregoing I have avoided the unfailing admonition of every textbook writer who reluctantly gives a paragraph to the problem of pruritus ani. The instruction I refer to is "remove the cause." I believe that the foregoing has contained enough worthwhile advice to pardon the repetition of so old a maxim and I believe that if my suggestion of a thorough rectosigmoidoscopic and general physical examination be followed out that this instruction will come nearer observance than when it is merely accompanied by an "unfailing remedy."

Visceral pelvic diseases as a cause of a misreferred pruritus should always be considered. Much greater detail on this very important phase of pruritus ani will be found in my monograph on the subject. If the comments offered herewith induce a more rational view with respect to the analysis and treatment of pruritus ani cases than is customary, I am sure that there will be numerous grateful patients throughout the land. In the field of rectal diseases there is no greater certainty than this: *Every case of pruritus ani can be cured.*

THE INJECTION TREATMENT OF
VARICES & ULCERS
OF THE LOWER EXTREMITIES*

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NEW YORK

WHILE arterial circulatory disturbance of the lower extremities is but a recent chapter in medicine, the recognition of venous disturbance dates back to Hippocrates, who noticed the relationship of varicose veins to ulcers of the leg. It was more thoroughly studied by the Alexandrian school and by Galen and his pupils. They stressed the importance of disturbances of the venous system in the etiology of recurrent ulcers of the leg, and they even made attempts at surgery. They tried to remove the blood from these veins, which they termed melancholic or black bile blood. Aegelleta in the 15th century spoke of the danger of varicose veins and also of their relation to ulcers of the leg. He condemned meddling with these veins, and believed that meddling would cause hydrops, phthisis and mania. Later, a good deal of attention was given to this subject by Paré and his pupils. Still later men like Morgagni, Valsalva and John Hunter studied the subject thoroughly and they considered that the stagnation of blood in these veins was the sole cause in the pathogenesis of ulcers of the leg.

Various theories have been advanced as to the cause of varicose veins. We believe, however, that no one of the following factors is the sole cause: Sicard of Paris considers this condition due to an endocrine disturbance of the ovary and pituitary body. Some of these cases are undoubtedly due to this cause and are seen primarily in young women who have large thick legs, who may give a history of definite menstrual disturbances and may present other evidence of endocrine disturbances, such as excessive growth of hair on the lower extremities. Meisin believes the condition is due to a general weakness of the structures of the veins, and associated with it may be other evidences of body tissue weakness, as flat feet, enteroptosis, etc. Undoubtedly this cause plays a very important rôle in a great majority of cases. Kashimure, a Japanese surgeon, believes it is due to loss of neuromuscular tone in the vein walls. Others believe that syphilis plays a very important rôle in the etiology (Zinsser and Phillips).

On the other hand, such authorities as Fisher, Noble and Renzi believe that varicose veins are due to an infection involving the vein wall, probably embolic in nature, often superimposed upon a hereditary predisposition. There are undoubtedly a number of cases in which one or more of these factors play a definite rôle in the causation. We are of the opinion that in a great number of cases trauma, producing inflammatory or cicatricial bands, constricts the veins, producing disturbances in the flow of blood. The action is similar to that of Jackson's bands in the cecum. The lumen of the vein becomes distended and dilated and the elasticity and tone are diminished or entirely lost, producing a stasis of blood in the vein, predisposing to the formation of ulcers and thrombi.

Varicose veins are most frequently seen in women over thirty years of age, although many are noted in younger individuals who have definite evidence

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of endocrine disturbance. Several factors account for their frequency in women. The most common is frequent pregnancies and childbirths. Tumors of the uterus, ovaries, retroflections of the uterus and constipation are also causative factors.

Undoubtedly sufficient muscular activity aids to promote normal circulation in the lower extremities, and we realize the inactivity of women as compared with men. However, since women are entering the various athletic fields, since interest in birth control is widespread and since early surgical intervention in pelvic tumors is now common, we will most likely see a definite decrease in varicose veins in the future generation. Varicose veins are also seen in men, especially those engaged in occupations requiring long hours of standing and heavy lifting.

We have been amazed at the almost entire absence of varicose veins in colored patients. Myauchi calls attention to the fact, also, that it is not a common condition in Japan, and he attributes this to the sedentary life and peculiar sitting posture of the Japanese.

SYMPTOMS

These depend upon the extent of involvement of the veins and the presence of ulcers, eczemas, phlebitis and neurodermatitis. In simple dilatation of the veins the symptoms may not be marked. Such patients will be more disturbed by the visibility of the veins than anything else, and with the modern trend in dressing this is a very disturbing factor to women. Others may complain of becoming easily fatigued from walking. The area involved feels much warmer to touch than the surrounding tissues. In severe cases, where there is phlebitis or periphlebitis, the pain may be severe. There may be fever and other constitutional disturbances producing disability, preventing patients from following their usual occupations. Some patients complain of severe cramps in the legs while walking, hence the German name *Krampfadder*.

TREATMENT

The treatment in the past may be divided into two classes, conservative and radical. The former aims to give relief by means of elastic stockings and other supports. The latter consists of various operative procedures that vary from simple ligation to extensive removal of the veins. The writers believe that in the most radical operations the surgeon cannot hope to excise the various communicating veins. In the writers' series of cases a number were met that showed recurrences following extensive operative procedures (Fig. 1, Case 1).

It is not our intention to discuss the merits of the various methods employed in the treatment of varicose veins. Yet it is our firm conviction that the chemical obliteration of varicose veins is the nearest approach to a complete cure.

The ancient physicians recognized the relationship of varicose veins to ulcers of the leg, and they attempted to obliterate these veins by means of various pastes. Later, attempts were made by perivenous and intravenous injection of chemicals to obliterate these veins. Some of the chemicals used were alcohol, iron, carbolic acid, ergotin, etc., but on account of the occurrences of fatal hemorrhages, infections and emboli, these procedures were given up. These attempts were mainly made following the invention of the hypodermic syringe by Pravaz in 1851. A great impetus was given to this treatment in 1916 when Linser and Zirn, in treating cases of lues by the injection of bichloride of mercury intravenously, noticed the frequency of hardening of the veins, and it occurred to them to employ the same procedure for the obliteration of varicose veins of the lower extremities. After using this solution for a time because of the frequency of mercurial poisoning and other disadvantages they began the search for a non-toxic substance, and came upon a 20 per cent to 30 per cent salt solution. Sicard and Forestier, during the War, while

injecting certain solutions into the veins at the bend of the elbow, observed that these veins hardened. They began to

aseptic phlebitis or venitis, and eventually obliterating the vein.

In giving this treatment one should be
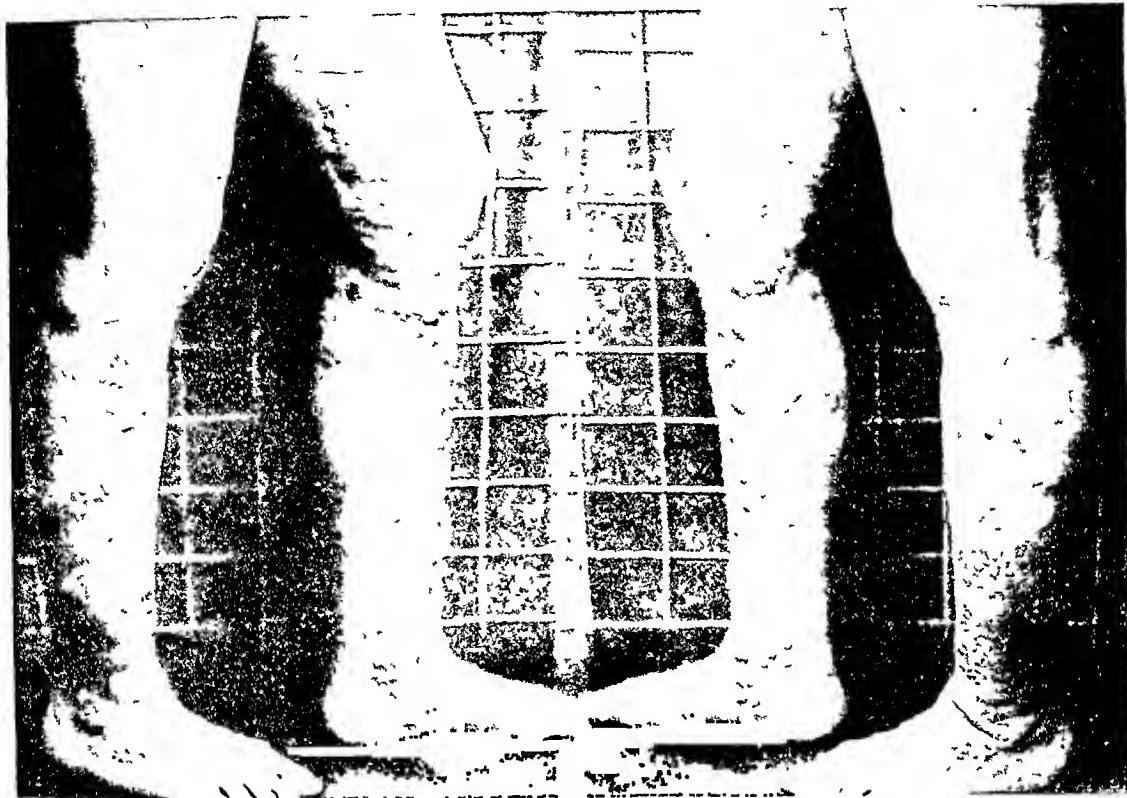
FIG. 1. Case 1. Before treatment. B. K., male, aged thirty-five, operated on twice for varicose veins with recurrences. Received 4 injections of 6 c.c. of sodium chloride with obliteration of veins. See Figure 2.

study this phenomenon and noticed that the hardening was caused by the alkalinity of the solution employed, and they used this method for the obliteration of varices of the lower extremities, using sodium carbonate, but abandoned it on account of its extreme causticity. They further experimented and employed sodium salicylate. In England quinine and urethane preparations are used, and Noble uses an invert sugar solution. Each preparation has its advocates.

In our series of cases we have employed exclusively either sodium chloride 20 per cent, or sodium salicylate 30 per cent. Occasionally we have encountered cases that did not respond to the ordinary solution and have been obliged to use a stronger one. The theory of this treatment is based upon the action of the sclerosing solution upon the vein wall producing an

absolutely certain that the needle is in the lumen of the vein. The entrance of the solution around the veins into the surrounding tissues will most assuredly produce a very painful, slowly healing slough, which is not only disturbing to the patient but discouraging to the doctor.

The amount of solution employed varies from 1 to 10 c.c., depending upon the size and extent of vein injected. No definite law can be proclaimed as to this. Experience and careful study of each case will help one to determine the amount to be employed. One can use a greater amount of the chloride than of the salicylate solution.

At the time of the injection the patient will experience no pain, provided the needle is within the lumen of the vein. Following the injection, however, he will suffer a cramplike pain which radiates

down to the toes. The salicylates produce severer cramps. We have noticed that the longer the cramp lasts, the better the

FIG. 2. Case I. After treatment.

results; generally the cramp lasts from fifteen seconds to two minutes. Note that we use the word cramp and not pain. Pain usually signifies either a leakage of the solution from the veins or the extension of the injection outside the veins. If this happens, the pain will increase in severity from hour to hour and day to day, and it may last for quite a time, from several days to several weeks, depending upon the extent of the slough it will produce. We use no tourniquet, because, not only does it produce pain, but it also produces stasis in the vein, diluting the solution employed with less chance for its action upon the intimal lining of the vein. The needle should not be withdrawn until pressure is exerted over the site of injection by means of a gauze pledget. Care should be taken that there is no leakage from the needle puncture, otherwise a painful bleb will develop. The patient should not be discharged therefore until the dressing has been inspected and found to be absolutely dry.

Following the injection one can observe the contraction and hardening of the vein. If the vein is tortuous, it begins to straighten out; it seems that this is due to the stimulation of the vasoconstrictors in the vein walls. The extent of the hardening varies with the amount of solution used and the dilatation of the veins. It is generally from 2 to 4 in., and always below the site of injection, proving that the solution does not enter the general circulation, but tends to descend towards the periphery. This is due to the high specific gravity of the solution employed and to the poor circulation in these veins. The dressing may be removed the next day or within forty-eight hours. Generally during that period the vein is noted to be hardened and the skin has a slight copper color and may be tender to touch. This is the so-called chemical venitis of Sicard. In a great number of cases the tissues surrounding the veins will become indurated, the so-called perivenitis. Sicard claims that the greater the perivenitis, the better the results are, and we firmly agree with his conclusion. At the end of two or three days, if the reaction is not severe, and in the absence of a slough, another area may be injected. We inject one segment at a time, because there is less likelihood of disability if one injection is given at a time. If the reaction is severe, the second injection may be delayed for a few days. The number of injections required depends upon the extent of the involved veins and upon the individual response; not all individuals respond alike. We found that tall, thin individuals, young individuals and men respond most rapidly to this treatment. The hardening produced in the vein disappears by absorption within one to six months. The longer the time required for its disappearance the better the results.

TECHNIQUE

In treating veins below the knee, except those of the calf, the patient may be seated

with the legs in a dependent position. The veins of the calf and those of the thighs are best treated in a standing or lying position. The preparation of the skin is very important. We use a 50 per cent solution of alcohol to clean the skin. Iodine has its objections, as it obscures the veins, making the injections more difficult. The needle and syringe should be made absolutely sterile despite the fact that the solutions are supposed to be self-sterilizing. One should use a sterile solution. A 20 to 22 gauge sharp needle should be used, for if the needle is dull and one must use force in inserting it, one may penetrate the posterior wall of the vein and cause a dangerous leakage. Again, no solution should escape from the needle before entering the vein. The point of entrance into the skin should be directly over that of the vein, so that if any leakage is to occur, it may have a direct line of exit. The valve action obtained by drawing the skin away from the site of entrance into the vein is not advisable, as the danger of a slough is greater. One should not attempt to inject the solution until he sees a strong flow of blood into the syringe.

Certain sites should be avoided, such as veins directly over the tibial bones; also over joints, and over the tendon Achilles because if we are unfortunate in getting a slough, the damage done may be very great.

EFFECT OF THE SOLUTIONS

Sicard, Forestier and Meisin, in careful studies of the veins of animals injected by these solutions, have noticed that the liquids have no coagulative action on the blood.

The action of the solutions may be described as follows:

1. Simple thickening of the vein wall; what we would call a vulcanization process in the wall. In such cases the lumen of the vein is not obliterated. This is most frequently seen in the very large veins of the thigh, but if one injects the same area several times, the vein is obliterated, and

in such cases stronger solutions may be necessary (Fig. 4, Case 11).

2. Sclerosing and hardening of the vein;

FIG. 3. Case 11. Before treatment.

the vein hardens and the lumen is obliterated. This is observed most frequently when using the salicylate preparation.

3. Obliteration and induration of surrounding tissues, so-called perivenitis, is most frequently observed in thin-walled veins, and with the use of the chloride solution. These cases give the best results.

The microscopic changes observed in the veins are cloudy swelling and destruction of the endothelial intimal lining. These produce an abundant exudate of red and white cells with a proliferation of fibrinous tissue deposited upon the vein wall, which immediately begins to organize into a very firm mass. The vein is felt as a firm cord, and is easily palpated by the finger. We have found that the salicylates produce this reaction much more rapidly than the chlorides.

In ulcer cases the procedure depends upon the condition of the ulcer and the surrounding tissues. If the ulcer is badly infected it is best to put the patient at rest and apply wet dressings for a short

time until the ulcer looks cleaner. Generally such an ulcer is surrounded by thrombosed veins, but this does not constitute

of the healed ulcer is very hard and indurated, showing less tendency to break easily. In ordinary cases, at the time of

FIG. 4. Case II. After treatment. S. D., female, aged sixty-four. Very large varicose veins, also eczema around internal malleolus of right leg for about nineteen years. Relieved of all symptoms and ulcer healed after 4 injections. No response to 20 per cent sodium chloride solution, but good response to 30 per cent. Though lumen of veins above knee not obliterated, patient is so well satisfied that, on account of her age, no further treatment given.

a contraindication for the treatment. We select the vein which feeds the ulcer directly; such veins are generally found above or below the ulcerated area. The amount of solution employed in ulcerated cases is less than in clean cases, as the reaction is much more severe than in ordinary cases, evidently due to the infected area surrounding the ulcer. This however is not alarming, but it may be necessary to delay the second injection for a week or so. Very distinct local changes will be noted in the ulcer following the injection. Within a few minutes oozing of serum will be observed from the ulcer base. An ulcer which has not healed for months or years will begin to show evidence of healing within two days. The scar

treatment, we do not use any supporting bandages. In ulcer cases it is advisable to use, both at the time of treatment and after treatment, a supporting bandage. McPheeters, who has an extensive experience in the treatment of ulcers by this method, also advises the same procedure.

In eczemas, especially the weeping kind, the improvement is also very rapid. The itching and the discharge become less and in a short time disappear altogether. These patients are the most grateful of all.

If the patient's general condition is good and no contraindications exist, they may be treated by this method. Our oldest patient was a woman seventy-one years of age. Injection should be avoided during

menstruation as it seems that the reaction is then more severe.

ADVANTAGES OF THIS TREATMENT

The writers agree with McPheeters, Sicard, Noble and Linser, that this is the best treatment for varicose veins and ulcers. An advantage from an economic point of view is that patients are not prevented from following their daily labors. There is practically no danger of emboli. The danger of anesthesia and the discomfort associated with it in operative cases are avoided here. Further, operations leave disfiguring scars, and this prevents a great number of women from submitting to them; while in this treatment there is no disfigurement whatsoever. Whereas postoperative recurrences are common, by this method of treatment no recurrences have been reported. Indeed, it seems that these patients improve with age.

COMPLICATIONS

Although emboli have been reported, we had none in our series of cases. The only unpleasant complications we had were sloughs; but with improvement of our technique and proper precautions, they should not occur. Occasionally, with the best of technique they will occur, especially in cases where the vein wall is very thin. A slough is characterized by a blanched cyanotic area, with considerable inflammation and induration of the surrounding tissues. It is very painful, the skin always becomes black and gangrenous, and after a while, it shows evidence of separation from the surrounding tissues. Sicard, Linser and McPheeters advise the injection of normal salt solution into the area where a slough is suspected, claiming that this will dilute the solution and may prevent the formation of a slough, or lessen its extent. We have had no experience with this procedure. After the slough is formed, McPheeters advises complete excision of the slough area and suturing of the margins of the wound. We do not agree with him on this point. We believe it is best to wait until the slough separates and keep the edges of the wound strapped.

The writers had no emboli in their series of cases. These generally occur within a week or even later after the injection. In operative cases, according to American authorities, emboli occurred in 7 per cent. According to the German authorities it is over 1 per cent. In a careful study of the subject of emboli and mortality by McPheeters and Rice, using this form of treatment, in over 53,000 cases they were able to find only 7 cases of death; 4, or about .0024 per cent, were from emboli. These cases have occurred mainly in those patients who had a recent phlebitis or where coagulating solutions were used.

CONTRAINDICATIONS

1. Diabetes. In such cases the reaction is more severe and the danger of slough is greater, although Sicard does not consider diabetes a contraindication.

2. Pregnancy and Pelvic Tumors. In these cases the treatment should not be undertaken until several months after labor, or after the operation for the tumors.

3. Acute inflammatory condition of the pelvic organs.

4. Acute or sub-acute phlebitis should not be treated by this method until all evidence of inflammation has subsided, as these cases are very dangerous and are the most frequent cause of emboli.

5. Arterial Circulatory Disturbances of the Lower Extremities in Men. No man should be injected until one is absolutely positive that the pulses in both feet are present and normal.

6. Severe Organic Diseases, such as Pathological Heart and Kidney Conditions. These cases are best treated conservatively.

CHOICE OF SOLUTION

We have had no experience with quinine, mercury or glucose. Our experience has been mainly with salt or salicylates. Our preference is for the salt. The advantages of the salt are: First, it does not produce such severe cramps as the salicylates;

second, it is not toxic. The only disadvantage is that if injection has extended outside the vein, the slough produced is much severer and larger than that produced by salicylates. The salicylates sometimes produce poisoning in individuals who have an idiosyncrasy. This is manifested by dizziness, scaly eruption on the body, and even vomiting. We had 2 patients who vomited for twenty-four hours. Again, the cramp-like pain produced after the injection is sometimes excruciating. All these symptoms will disappear with the discontinuation of the salicylates.

Occasionally one will find individuals with very large veins who do not respond to a 20 per cent chloride or a 30 per cent salicylate solution. Such cases will respond very well to a 30 per cent chloride or a 40 per cent salicylate solution, as in Case II.

CONCLUSIONS

We believe the injection treatment to be the best procedure in cases of varices and ulcers for the following reasons:

1. It is the safest treatment: There is no danger of emboli and anesthesia.

2. There is no disfiguration.

3. Economically there is no loss of time and earning capacity.

4. The results are permanent.

We quote McPheeters in his conclusion: "The injection treatment of varicose veins has passed the experimental stage and has proved to be a very rational form of treatment which should be accepted as supplanting other well recognized methods of therapy."

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THE APPLICATION & REMOVAL OF
PLASTER-OF-PARIS BANDAGES[*]

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FULLY cognizant of and accepting much of the advance made in the treatment of fractures by traction methods with the limbs in suspension, I submit that there is none the less a large field of usefulness for the plaster-of-Paris bandage in the efficient treatment of a number of fractures, to attain which a precise technique is of the utmost importance.

I have repeatedly been called by physicians to counsel them as to why the plaster-of-Paris apparatus applied did not function. Most of these casts were badly made, brittle in places, messy looking rather than neat, *eye sores*, obscuring instead of aiding in the correction of the deformity, being either too tight or too loosely applied, *trouble makers*, creating much of the misery they should have relieved. These pitfalls can be avoided by observance of the directions about to be set forth.

MAKING OF THE PLASTER-OF-PARIS BANDAGE

You cannot put on a proper plaster-of-Paris bandage if you depend on the variety sold in the shops. Only the home-made hand-made bandage will yield the best results; therefore "Roll your own" materials. The plaster-of-Paris should be of the superior quick setting quality used by dentists, and packed in tin cans to guard against absorption of water (hydration). It should be stored in a dry place until used. Furthermore the hand or receptacle introduced into the plaster should be absolutely dry. Gritty particles in the plaster disclose that hydration has taken place.

Crinoline or tarlatan 28 × 32 mesh is the fabric into whose meshes the plaster is rubbed by hand. The crinoline is cut into strips of the widths desired and loosely rolled in 10-yard lengths; ¼ of a yard at a time is unrolled and plaster rubbed into the meshes of the gauze; and as each length is so treated, it is rerolled loosely. This arrangement permits the rapid and uniform spread of the water to all parts of the bandage when immersed for usage.

The completed bandages should be placed on end in the can or in individual containers. Additional protection from moisture may be had by wrapping each bandage in tissue paper, newspaper or waxed paper and finally sealing the can with adhesive tape.

IMMEDIATE PREPARATIONS FOR APPLYING THE PLASTER-OF-PARIS BANDAGE

The surgeon and his assistants should wear sleeved gowns extending the length of the body to protect soiling of the clothing. In like manner the floor covering, the patient's body and the couch or table should be protected against scattered plaster. It should be borne in mind that if a properly made bandage (home-made) is used, which need be but slightly compressed to rid it of superfluous water, no drippings will be scattered and the whole procedure will be attended with no soiling.

The number of bandages intended for use should be removed from the container and stood on end within 1 ft. of the vessel in which they are to be singly immersed. Such arrangement guards against spattering and rendering the bandages unfit for further use. Place the bandage end-wise in hot, *not cold* water sufficient to submerge it well and allow it to remain unmanipu-

lated until the bubbles cease coming off. Then remove the bandage, squeezing it slightly but a single time to rid it of excess of water. To hasten the setting of the bandage some recommend the addition of salt or alum to the hot water. This accelerating of the setting is not of advantage inasmuch as the bandage is prone to set in the hand before it is unrolled onto the limb. With the home-made bandage prepared as previously described with the quick setting plaster the addition of chemicals is superfluous.

PROTECTION OF THE SKIN AND SOFT PARTS

This protection may be accomplished with a choice of materials. The area to be invested may be wrapped in cotton wool (sheet wadding) or a flannel bandage or an elastic (Ace) bandage. Any of these must however be applied without wrinkles lest they exert pressure under the plaster. An elegant investment of the skin is afforded by tubular stockinette (tricot hose) to be had in desired length and width from supply houses. Failing such, a stocking or glove or a sleeve or leg of underwear may be used. When the plaster-of-Paris bandage is applied to serve as the mould the limb need only be anointed with vaseline. In addition to this investment all bony prominences should be protected against pressure by a supplementary padding of cotton or felt. The plaster-of-Paris bandage should be wrapped, not pulled, about the limb and free from any reverses in the first layer where they might exert pressure. On the outer turns reverses can be employed, to add strength to the bandage; as each successive turn of the bandage is made it may be smoothed by stroking of the hand moistened occasionally with water. Do not at any time add any loose plaster or paste from the vessel, as such excess plaster adds to the weight when lying between the layer, not having been incorporated with the meshes, and when applied to the outermost layer as a smooth top dressing particles will become detached, find their way beneath the bandage and soil the clothing and floor coverings.

Where a tubular tricot hose is used, it should be twice the length of the limb so that the extra length can be drawn over the completed cast until the two edges meet, when they are sewn together. The upper and lower ends of the plaster bandage itself must not extend beyond the underlying investing material.

A smooth finish may be given to the ends by turning the ends of the underlying bandage over the plaster-of-Paris bandage; or a cuff effect is obtained by securing a cuff of cotton by a turn of plaster bandage at each end. This refinement prevents the rough ends of the plaster from scratching the skin. When the flexure of a joint (knee or web of a thumb) is encroached upon by the limits of the plaster a crescentic section may have to be removed sufficiently to eliminate the interference with motion. Such section should be done with a sharp penknife or discarded scalpel while the bandage is still plastic.

Again, with the bandage in the plastic state, it can be made to conform to the contours by pressure and massage-like motions, far better than by traction on the bandage. No undue traction should be made in applying the successive turns of the bandage. The use of any other than a light hand, when unrolling the bandage onto the member will be followed by such constriction of the limb as will necessitate prompt and immediate removal of the bandage. It is most important to exercise every precaution to place a plaster-of-Paris bandage correctly in the first instance, for its immediate removal because of faulty and inadequate application is a painful procedure, and such uncalled-for and unnecessary experiences have brought the usage of these bandages into bad repute. A committee of the American Surgical Association on fractures says, "A circular plaster-of-Paris dressing is permissible when completely divided in at least one line." Such a division can be effected immediately, the bandage being

in a plastic state, by running a sharp pruning knife along the prominent part of the bandage; or if the division is left to a later moment the splitting may be done with properly constructed plaster shears (Stille's shears); or failing to have such, a few drops of acetic acid or a 50 per cent citrate soda solution will soften the plaster and permit the quick and easy cutting of a groove. Some deem it expedient to place a strip of zinc ½ in. wide or a wire next to the limb before starting the plaster bandage and to allow the ends of the metal to protrude as a guide in starting to cut the groove so as to have the knife strike the metal and avoid injury to the soft parts beneath.

In the treatment of Pott's fracture plaster-of-Paris finds its widest application and I therefore chose to feature its application thereto as a type upon which all other applications of plaster-of-Paris for fractures may be modeled.

APPLICATION OF A PLASTER CAST FOR POTT'S FRACTURE

Such a cast must extend from the toes to the knee joint embracing the condyles and not going merely half way up to the calf and so cutting into the flesh at that improper level. (Four to six bandages may be required, depending on the proportions of the limb.) With this in mind the limb is invested with tricot stockinette or flannel bandage from the condyles of the tibia downwards including the foot to the webs of the toes. Reduction of the fracture is more frequently under an anesthetic either manually or by mecanical device (Hawley table). The foot must be brought from equinus posture to that of a right angle and varus to offset the valgus position. Thus corrected or even over-corrected the boot should be held by assistants as follows:

The heel is supported in the grasp of the index finger and thumb of the left hand of the assistant whereas with the right hand pressure is exerted upwards on the foot by the right thumb pressing on the ball of the toe forcing the foot into the right-angle position. If now the knee be flexed to a right angle and steadied by another assistant, stationed at the head of the table grasping the calf at the same time, the tendo Achilles will be relaxed and the equinus give way to a right-angle position. When there is no assistant to hold the foot, a sling of muslin is passed about the arch or even tied to the big toe and either end held taut by the patient if he be conscious; or the ends of the bandage are fastened to the upper ends of the table. The sling about the arch may be enveloped in the turns of the plaster and the protruding ends cut after setting has taken place. Extra padding of felt or compresses of cotton batting should be applied to the malleoli, a strip of cotton along the crest of the tibia, a cuff about the condyles of the tibia and also a pad over the dorsum of the foot and finally sufficient padding to maintain and if necessary restore the normal hollow of the arch. Flat-foot (valgus) is very prone to follow Pott's fracture, to obviate which the foot should be well inverted (varus) and be kept in a right-angle position.

The upper limit of the cast anteriorly must hug the condyles but posteriorly that level has to be reduced by cutting away a crescentic strip sufficiently to permit flexion to a right angle. Below the plaster bandage should extend to the webs of the toes subsequently easing up the points of pressure by splitting the bandage along the fibular and tibial borders, but under no conditions attempting the same easement by cutting away a portion of the bandage in a circular direction.

Some surgeons would have the upper limit of the cast at the condyles, others would include the knee joint. The choice may be set down as follows: Where the fracture is limited to the ankle joint a cast extending to the condyles is sufficient, whereas fractures above the middle of the leg call for the immobilization of the knee also, and under these latter circumstances

the cast should be carried up to the gluteal fold posteriorly and Poupart's anteriorly.

The bandage should remain on two weeks before removal. The splint may then be sprung apart and attention given to the toilet of the soft parts. Following massage and slight active and passive motions in recumbency it is replaced and the gaping edges approximated by strips of adhesive plaster. Daily removal may then be undertaken for another period of two weeks after which, although the limb may not be in a weight-bearing condition, early restoration of ankle motions will be more likely to be obtained by discarding the rigid plaster dressing.

A lingering mistrust of the use of the plaster-of-Paris bandage is based on the dangers of gangrene and ischemic paralysis setting in because of the popular fallacy, "the immediate use of the plaster-of-Paris bandage at a time when there is much swelling." Immediate use does not imply instant use. It should be borne in mind that usually several hours elapse before all conditions are met for applying the bandage. Hence there need be no dread of still further increase of the swelling under the bandage. Indeed the best means of combating the swelling is complete prompt immobilization. The first step towards this is expressed by the slogan "Splint 'em where they lie;" then comes elevation of the limb to be followed up by gentle massage and the use of a compressing bandage for a few moments before placing the cast.

If after all the aforesaid precautions there still are pressure signs such as increasing redness with throbbing and pain or on the other hand coldness of the limb or livid color of the toes and numbness, then extreme elevation of the limb with administration of an opiate to insure absolute rest may dispel all these in the course of an hour; if contrariwise, the *cast must come off*.

The American College of Surgeons has included the plaster-of-Paris bandage among the essentials for an efficiently equipped fracture service.

Because of the splendid response to its previous exhibits the Fracture Committee of the American Medical Association has been requested to demonstrate for a third time, at the forthcoming meeting at Portland, Oregon, the "Making, storing, and use of the plaster-of-Paris Bandage" as an essential of its program.

Evidently the plaster cast has not lost caste.

SUMMARY

The "high spots" in the effective and efficient use of the plaster cast may thus be summarized:

1. "Splint 'em where they lie."
2. "X-ray 'em."
3. Elevation and massage with compression.
4. Anesthesia for reduction and during application.
5. Use only home-made bandage; roll your own bandage.

GANGRENE OF THE FOOT*

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TO find a satisfactory basis for the treatment of foot gangrene it becomes necessary to analyze the various groups coming under this heading.

We can distinguish, in the main, three groups.

1. Trophic ulcers (the true Raynaud and ulcers following nerve affections).
2. Arteriosclerotic gangrene.
3. Thromboangiitis obliterans.

As far as the first type is concerned we must realize that local treatments of any kind will show very little influence on the process. Unless we can take care of the underlying cause, and in many instances we do not know it, we only can protect the ulcer but not hasten the healing.

The difference between the second and third groups lies in the fact that in the arteriosclerotic form the inflammatory reaction is secondary, due to an infection, while in the third type an inflammatory process of unknown origin exists.

For this reason we find in the thromboangiitis obliterans, a phlebitis, (phlebitis migrans) and very frequently signs of an inflammatory process with swelling, redness and pain.

The most satisfactory results are obtained by intravenous injections of a 5 per cent saline solution. Though not all cases respond favorably, I have seen the most astounding recoveries in the clinic of Dr. Silbert following this treatment.

In many cases, such as old age, this method cannot be used and in these cases physical therapy is called upon to obtain a cure.

Most people are using heat in various forms, but the object of treatment is not, as commonly thought, to increase the arterial circulation but to improve the local circulation.

This is by no means a sophism. In many cases the circulation is not so bad on account of deficiency of the arterial blood supply, but in consequence of an inflammatory process the venous and lymph circulation is interfered with and the nourishment of the tissue becomes deficient.

If we, as is generally done, institute heat therapy, be it diathermy or hot air treatment, the arterial blood supply will increase and, on account of the insufficient outflow, the local stasis will increase and the condition of the affected part will become more aggravated. A number of times I had very unfortunate experiences, whenever a local cyanosis existed. The ulcer and the infection spread rapidly and the patient died in spite of an operation. I consider heat treatment contraindicated in all cases with cyanosis.

Following this trend of thought I tried to improve the local circulation by taking care of the edema. This can be done by gentle massage, peripheral from the ulcer, three to four times a day for about fifteen minutes.

In 2 cases in which I put this idea into execution I was able to obtain a very satisfactory result.

A man of about seventy years showed a gangrene of four toes on one foot and of three toes on the other. The toes were perfectly black, the entire foot very swollen. I gave instructions to massage the leg three to four times a day, and the ulcers healed after two months.

Another patient, a man of eighty-four years, likewise showed a marked improvement, but a few months later he died from a heart attack while sleeping.

I should strongly object if one would impute to me the idea that massage can

cure an arteriosclerotic ulcer. It does not, but massage improves the local circulation in cases with marked edema and with the improvement of the circulation the ulcer heals.

This experience illustrates well the principle which should guide every effort · to use physical therapy. The question is what kind of assistance the organism needs. Which one of the modalities is best suited to supply these needs is another question.

The problem is different if the local condition indicates that the arterial circulation alone is at fault; then heat treatments are in order. In some cases diathermy should be the method of treatment; in others preferable treatments are conductive heat, hot air, infra-red rays or white light.

Diathermy is best applied in the following way: Two glass basins are filled with 15 per cent salt solution and a plate electrode, connected with one pole each, placed on the bottom. This electrode is covered with a towel and one foot put on each. The current then goes through one leg into the other. The advantage of this method is that a burn is impossible.

In another method a cuff electrode is tied under each knee, padded with a towel soaked in salt solution. The feet can then be placed in one basin in the same way. If one desires to treat only one foot the same method can be used by preparing only one leg. If both feet are treated at the same time the cuff electrodes are connected with one pole by means of a split connector.

The strength of the current is about 600 to 700 ma. for half an hour. The number of treatments a week depend on the reaction of the patient. It is not always advisable to force the treatment.

In case one uses conductive heat good care must be taken to protect the toes. The temperature used in these methods is very high, sometimes 280°F to 300°F. It is obvious that the tissue cannot stand this amount of heat unless it is cooled by the circulating blood. In these cases the circulation is very poor and the cooling of the tissue insufficient, so that severe burns may result.

Generally the order is given to take the treatment three times a week. This prescription is illogical. If we want to improve the circulation by dilating the arteries, and it has been said that this is not always desirable, we must give long and frequent treatments.

This point of view is particularly important if we want to find a solution in a very vexed problem.

It is well known that in most cases operated on for gangrene of the foot, even when amputation is made above the knee, the healing of the wound is very slow, the sutures do not hold and new ulcers appear which heal very slowly, if at all. Generally heat treatment is resorted to after the ulcer appears. This is a very inefficient· method for handling such cases. To get a primary union we need very good circulation. In fact the circulation cannot be too good. It is, therefore, advisable to start the heat treatment before the ulcer appears and if possible immediately after the operation.

In one of my cases, operated on by Dr. H. Lilienthal, heat was applied from the time the patient was brought down from the operating room. A lamp was placed over the dressed wound. The patient left the hospital eleven days later with a perfectly healed wound.

· In conclusion I may say that the object of treatment is to improve the circulation and that the method to be used must be selected accordingly. The end-results in most cases are not very good. In fact, treatments improperly pushed may even aggravate the condition. I saw a case in which amputation seemed to be the only recourse improved by Christian Science. This simply shows that some cases may be better off ·by being left alone.

CARTILAGE INJURIES[*]

A CLINICAL STUDY

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IN a previous article upon this subject, the fingers, wrist and elbow have been dealt with. We now extend the study to the area about the shoulder, including the associated bursae and acromioclavicular joints.

THE SHOULDER

·Although the shoulder is the most frequently dislocated articulation, it seems to me we give little or no attention to the various cartilaginous structures in our consideration of such an injury. Perhaps this is because of the ease with which a reduction is usually accomplished. The end results are, as far as we know, excellent, and therefore we dismiss from our minds any further thought of the associated lesions. Even the frequently accompanying fracture of the humeral tuberosity gives us little concern, since this is usually of the non-displaced (Type 2) variety, and the entire condition is thus looked upon as being only slightly more than a minor accident.

Before beginning a discussion of the more severe shoulder injuries, it is well to note that without a dislocation or neighboring fracture (which does not involve the articulation itself) a non-infectious synovitis of this well-protected joint may occur. We rarely hear of this diagnosis except when the knee is concerned.

Arthritis of the shoulder is often mentioned, but the exact nature of this arthritis, in the case of the shoulder, is likely to be omitted. As I stated in writing of elbow injuries, *traumatic arthritis* is a real pathological entity, and the presence within the shoulder is not uncommon.

No attempt will be made here to classify shoulder dislocations, nor will any of the methods of reduction be discussed. The object of this paper is to stimulate an interest in the part played by the cartilaginous tissues, in order that a more accurate diagnosis may be made in many obscure and obstinate shoulder conditions.

In every dislocation, of course, there must be an injury to both the synovial membrane and the articular hyaline cartilage. Undoubtedly, the intra-articular fibrocartilage is also damaged. This has been noted by a number of writers. Broca and Hartman have found "half of the fibrocartilage torn loose from its attachment."[2] Speed has observed "a splitting of the cartilaginous run," with "small fragments of bone within the joints."[3] Others have described an "indentation or shipping of the humeral head." Many months following a so-called simple dislocation, during a clinical examination, I have frequently noted a vague sense of joint crepitus. This is often felt by the patient, and I have known of instances where these symptoms served as an excellent excuse for malingering.[*]

It is my opinion that the looseness of the articulation explains why a cartilaginous displacement of the shoulder does not produce the severe symptoms found in a similar derangement in the knee. If at every opportunity offered to inspect the cartilage of the shoulder, careful observa-

[*] A nice method to detect malingering in the case of a failure of the patient to raise the arms above the head is to have him stoop forward with the palms of the hands resting upon a table. Then ask him to slowly step backward; encourage him to step way back. The arms are now held in the position they have reached by the examining surgeon, and the patient told to stand erect. As he does so, the arms will be found far above the head, and he is forced to admit they can be placed in this position.

[*] Submitted for publication January 15, 1929.

tions were made, soon we might be in a position to make a positive diagnosis and institute proper methods of treatment.

FIG 1.

The usual indications for opening the joint are as follows:

1. Fracture dislocation of the head of the humerus.

FIG 3.

2. Irreducible dislocation.

3. Repeated dislocation (with subluxation).

4. Disease of the head, requiring its removal.

To this list we may, after sufficient study, be in a position to add a fifth operative indication:

5. Loose bodies within the joint.

1. *Fracture-dislocation*. This condition demands an immediate operation and certainly involves the intra-articular as

well as the articular cartilage. It may be well to include here a lengthy case report which was also presented in a previous

FIG 2.

article by me on this subject.[4] This case report will serve to describe what I consider the most favorable method of opening the shoulder with the least amount

FIG 4.

of damage to muscles, nerves and blood vessels about this region.

CASE I. W. H., a truck driver, aged twenty-eight, fell about 20 feet into an elevator shaft December 8, 1923, and struck directly on the left shoulder, also fracturing the right forearm. He was operated on the following day. An 8-inch incision was made along the anterior margin of the deltoid muscle, a few fibers of which were separated but not cut. The tendon of the biceps muscle was found lying between the fragments. The head was completely dislocated below and anterior to the glenoid

cavity. There was a rent in the joint capsule on the upper posterior surface and the entire joint was filled with blood.

FIG. 5.

An attempt was made to reduce the dislocated head by pressure and by traction, but this was impossible. The joint was then opened on the anterior surface by an incision ½ inch in length and with a blunt curved periosteal elevator the torn fragments of the capsule and cartilage were pushed away. Using this instrument as a pry, with the end placed against the margin of the glenoid cavity, the head was rotated half a turn on the instrument, and easily snapped back into place. The opening was then closed and a reef taken in the capsule, so as to make the relaxed anterior portion very taut.

Some loose fragments of bone were removed and holes drilled through the head and through the shaft, which had ridden upward past the glenoid cavity and nearly pierced the skin above the shoulder joint (Fig. 1). The shaft was pulled downward and the fragments sutured with heavy kangaroo tendon. The biceps tendon was placed above the suture line and the wound closed in the usual manner.

A few days after the operation, the upper portion of the cast was removed from the forearm and motion in the hand and wrist begun, and on December 30 the entire cast was removed, the patient being placed in a "traction suspension" apparatus, thus allowing motion of the elbow and shoulder and the beginning of physical therapy.

January 10, one month following the operation, all appliances were removed and the

patient given a sling. Physical therapy was continued, and active motion encouraged by having the patient climb with his hand up the

FIG. 6.

standard of an irrigation stand, marks being made to denote each day's progress in voluntary abduction. I believe this to be better than climbing up a wall, as this permits the patient to grip his hands about the standard and encourages more extensive movements.

The end-results were excellent. Rotation was very little impaired, and full abduction was slightly limited. He has since returned to work as a truck driver.

2. *Irreducible Dislocation.* Here it is well to attempt a closed procedure, even as late as four months following the injury. Kocher considers a dislocation to be irreducible after the head has remained out of the glenoid cavity for from five to seven weeks. In attempting repeated forceful manipulations, one should not forget that numbers of cases have been reported where there was an injury to the axillary vessels or to the large nerve trunks about this area.*

* In this connection it seems well to stress the importance of the surgeon himself, at the time of his first visit, making at least a superficial inspection of the sensory and motor nerves supplying the upper extremity. It is to be recalled that in the region of the attachment of the deltoid there is on the lateral surface of the arm a small triangular area of skin which is supplied by the circumflex nerve. This may give a clue as to why there is a loss of the power of abduction, but in my experience a paralysis of this nerve is rarely seen associated with an injury which involves only the shoulder area.

Case ii. J. C., a man aged seventy-three years, fell down an elevator shaft. Roentgenograms were made, showing a dislocation of the
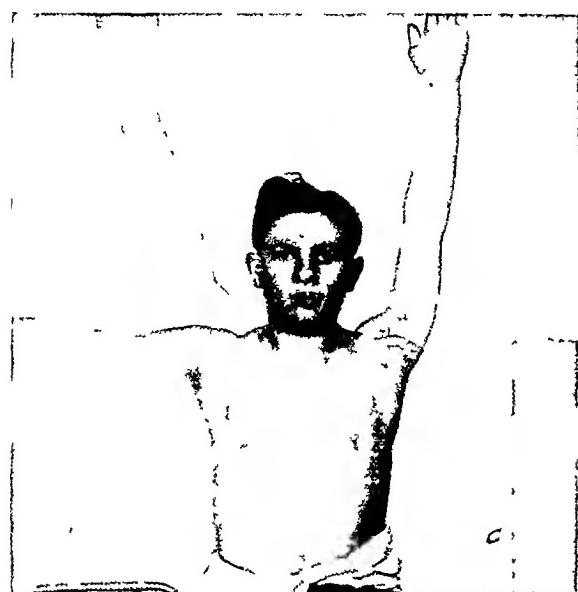
Fig. 7.

left shoulder which was said to have been reduced and the shoulder placed in a plaster of paris cast. When the cast was to be removed, it was noticed the bone had "slipped out of place some time during the four weeks that the cast was worn." I saw the patient at this period. He was referred to the Post-Graduate Hospital, where under a single gas-oxygen anesthesia I made several unsuccessful attempts at reduction. An ulnar nerve lesion followed. He was placed in a traction-suspension appliance, but because of his mental state, he repeatedly removed, not only the weights, but also the entire dressings. For years he had suffered with a heart lesion, and an open reduction under a "brachial block" or under local anesthesia did not seem advisable. His family removed him from the hospital, and one month later he died from his cardiac condition.

I recall seeing Dr. J. J. Moorhead operate upon an irreducible dislocation when the head had been allowed to remain out of the glenoid for about two years.

Case iii. T. O'C., a man aged fifty-two years, fell against a fly-wheel and dislocated his shoulder, two years prior to admission. The joint was filled with a huge amount of connective tissue which also seemed nearly to cover the articular cartilage of the humeral head. It was removed with great difficulty, and satisfactory reduction accomplished.

3. *Repeated Dislocation Due to Subluxation.* In certain cases this condition becomes a source of disability, and I have known it to be used as an excuse for malingering. Extensive operations have been described for deepening the shallow glenoid. These I have never attempted or seen performed. A simple reefing or plication of the capsule is often quite sufficient. To repeat what has already been said: at such an operation we should open the joint and observe the cartilage, a thing which often is not done. It has been very disappointing, in reviewing the operative records of such cases, to find frequently no mention whatsoever regarding the position, the fixation or appearance of the fibrocartilage or any of the various tissues within the capsular ligament. In cases where an absolute fixation of the joint is required or where there has been a destruction of the head and upper portion of the shaft of the humerus, I recall distinctly assisting at an interesting operation performed upon an army officer by Dr. Fred H. Albee. A bone graft was placed from the acromion process downward, and inlayed into the upper part of the remaining shaft, thus bridging over the area of bony loss and stabilizing the shoulder joint. Even with the shoulder fixed, it is surprising to note the amount of motion that can be obtained from the movements of the scapula.

4. *Resection of the Humeral Head for Disease.* The case about to be described may not seem to be closely related to the subject of cartilaginous injuries, in as much as the articular cartilage was not removed; still it will show what can be accomplished when the articular cartilage of the humeral head can be saved.

Case IV. B. S., aged seventeen years, a fur operator, while playing baseball slipped and fell on the extended left hand, causing a fracture of the surgical neck of the humerus (Fig. 5; this film unfortunately was scratched)

and osteitis fibrocystica in the region of the fracture. At operation the cortex of the bone in this area was found to be about as thick as an

Fig. 8.

egg-shell, and the cryptic areas filled with organized blood clots, some as large as walnuts, could be seen through the thin bony shell. The entire area was dissected, and the remaining shaft forced into the small epiphyseal portion of undiseased bone (Fig. 6). Bony union was rapid. On November 28 a prophylactic dose of deep roentgen rays was given in order to destroy any cells which might well have been allowed to remain. There has been no sign of reoccurrence during the past one and one-half years. The boy has gained weight. There is scarcely any limitation of motion (Fig. 7) and he has been able to return to his usual occupation.

One cannot leave a discussion of the shoulder without saying—(1) that aspiration of the joint is rarely thought of, probably because of the surrounding structure; (2) that prolonged immobilization is often carried out with injurious effects; (3) that baking and massaging are done in a routine manner; and (4) that this articulation is frequently more blindly treated than any other commonly damaged joint.

SUBACROMIAL, SUBDELTOID, AND SUB-CORACOID BURSITIS

In as much as these lesions are so closely associated with shoulder-joint injuries, a detailed description of them should be made in a study of cartilage injuries. The subacromial and subdeltoid bursae have

Fig. 9.

been known to communicate, and may be dealt with conjointly. Their exact location is illustrated in Figures 8 and 9.

There may or may not be a history of trauma. The onset is often sudden and unexplainable, or it may be slow and gradual as in the case of frequent small traumae in connection with an unusual occupation. During one year I observed five barbers, each with a bursitis of the left shoulder (the comb being held upward while cutting hair). I was tempted to describe a "barber's disease" after the manner of "housemaid's knee," etc., but for the past two years I have not treated a barber for this condition.

There is frequently a total disability to abduct the arm, and one may even consider a paralysis of neural origin until such a lesion can be excluded. The pain is excruciating or may be noticed only at night (the patient cannot sleep on the affected side). The pain, although it varies, tends to radiate downward to the elbow, or even as far as the hand. On examination, no swelling can be noticed through the thick deltoid. There is a very definite point of tenderness, not over 1 or 2 cm. in diameter, located between the

tip of the acromion process and extending downward as if running along the bicipital groove. It is by this area of tenderness,

FIG. 10.

with the exclusion of other lesions, that one may arrive at a diagnosis; but without a positive roentgenogram showing a shadow of the bursa I have never been content with such a diagnosis.

CASE V. C. G., a woman aged thirty-eight years, a dress-machine operator, said that in trying to open a large window, she "sprained her left arm." The following day the shoulder became extremely painful and "paralysed." Various lotions and ointments were applied without relief. There was a very small area of acute tenderness where the roentgenogram showed calcified deposits located within the subdeltoid bursa. The patient failed to return.

CASE VI. J. L., a man aged forty years, a private secretary, suddenly, three weeks previous to admission, developed a pain in the left shoulder. He had no unusual occupation, or had he undertaken any excercises which could account for his shoulder condition. The only possible explanation he had to offer was that commuting to his suburban residence he usually sat with that shoulder near the window. The man came to me with a typewritten history he himself had made of his case. He had gone through various tests, and brought a complete set of roentgenograms of his teeth.

There was a very small area of acute tenderness, such as already described, and on this point alone I made a diagnosis of subacromial bursitis which was confirmed by roentgenogram the following day. As Dr. W. H. Meyers of the New York Post-Graduate Hospital has had favorable results by treating these bursae with massive doses of roentgen rays, this was tried in November. One week following his treatment he was able to move the arm, and was entirely free from pain, except during extreme abduction.

Others have been treated with massage and baking, with excellent results, but the treatments are painful and the disability period extensive before a "cure" is effected. In obstinate cases a removal of the bursa is indicated. Dr. H. H. Ritter[5] has noted, after a careful complete removal, in two instances a recurrence of the symptoms. Later roentgenograms did not reveal any remaining deposits.

I personally have had no experience with subcoracoid bursitis, and quote from Goldthwait, Painter and Osgood:[6] "Subcoracoid bursitis may be caused by a faulty posture . . . The lesser tuberosity of the humerus rests against the tip of the coracoid process . . . Changes in attitude may cause a marked relief at once."

ACROMIOCLAVICULAR SEPARATION

The motion permitted at this point is of a gliding nature, on the part of the clavicle, while forward and backward rotation of the scapular is also possible but limited by the coracoclavicular ligaments. There is located within the joint a triangular fibrocartilage which is separated from the bones by a synovial joint cavity on one or both sides. That this fibrocartilage may become displaced has been frequently noted, as in the case reported by Speed where it was completely torn away from the end of the clavicle. The frequency of a separation of this joint may be judged from Kronlein's report of 400 dislocations, in which the acromial joint was involved in 11 cases, and the sternoclavicular in 6 instances. I myself have

seen only 5 cases of acromioclavicular. separation, one of which came to operation. The pathology may be explained by a

Fig. 11.

direct violence to the shoulder, which forcibly separates, or by an indirect violence, such as explained by Wilson and Cochran,[7] where a forceful driving upward of the scapula, causes the coracoid process to come in contact with the clavicle, and thus pry apart the joint. (See Fig. 8. Patient struck point A, and if the arm is carried across the chest separation must occur at point C.)

Case VII. A young man, aged twenty-eight years, in wrestling received a direct blow to the anterior shoulder. There was a distinct depression over the articulation noticed on clinical examination, about $1\frac{1}{2}$–2 cm. in length. It will be recalled that the normal anatomical separation of the joint is 1 cm., but this cannot be detected clinically. He worked as a drug clerk, and claimed that in reaching to remove even a light object from a high shelf, the sudden pain caused him to drop things. I operated upon him at the U. S. Marine Hospital, completely removing the intro-articular cartilage, and also the articular cartilage covering the bone ends, which were sutured together with kangaroo tendon. After four weeks there appeared to be a fibrous union. Thinking that such a union would be ideal, motion was begun. The case was seen nearly two years later. Although the symptoms were not so marked as to interfere with his work, he claimed that at times when reaching too high he still had a slight pain.

Case VIII. A. C., aged thirty-six years, a housewife, eight weeks previous to admission was hit by an automobile, and operated upon in

Fig. 12.

a neighboring hospital. Following the operation she came to our department for the first time, with an open wound. This was closed, and straps were applied to draw the joint together. Later she was given massage, and although persistent, the end result in function was considered good.

Case IX. E. S., aged fifty-five years, on July 16, 1927, was struck by a taxi. He came to the hospital two days later. Strapping was applied, which failed to correct the deformity, but after a period of time there was no remaining disability.

Case X. An army officer, about thirty years of age. In this case strapping was tried and later an abduction splint (which was worn much to the dislike of the patient). He was transferred from our hospital, and I was unable to follow the case to a conclusion.

It is my belief an early operation should be done in cases where great force is required, as in laborers, or in those whose unusual duties require reaching into abduction of more than a right angle, and that no wide range of motion should be attempted until firm bony union has occurred. I do not believe in any form of metal fixation. The only case I ever saw of a non-union of the clavicle was one in

which there had been an attempt to treat the condition by means of wiring.

STERNOCLAVICULAR DISLOCATION

I have seen a dislocation of the sternoclavicular joint on two occasions only. Although a fibrocartilage is interposed between the bones, reduction is usually easily accomplished. The difficulty is to maintain the reduction. One of the cases was in a young woman, where the deformity, and not the disability, was the cause of her seeking treatment. She was a housemaid, and the accident occurred in her attempting to shove a heavy basketful of fruit across the floor. Repeated adhesive strapping was tried, with little or no result. She refused operation for the fixation of the joint. Satisfactory results have been reported.

Recently Lowman[8] had described his operative technique for fixation of this joint, with a report of an excellent end result. It is to be remembered that a wide range of motion is permitted at this articulation. Personally, I have not had an opportunity of seeing the late end result following such an operation.

CONCLUSIONS

1. The shoulder joint demands more careful study.

2. Cartilaginous structures play an important rôle in all shoulder injuries.

3. Acromial bursitis is not a rare condition:

a. Such a diagnosis must be confirmed by roentgen ray.

b. Roentgen-ray treatments of this condition are indicated.

c. Operation should rarely be resorted to.

4. Acromioclavicular separation, if disabling, should be operated upon.

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FRACTURES OF THE FINGERS*

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PHILADELPHIA

FRACTURES of all kinds are the pet aversion not only of the general practitioner but of many surgeons. The reasons for this are twofold. In the first place the average physician will not take the time to equip himself with a thorough knowledge of fractures nor will he exercise the patience and painstaking and time-consuming care that is necessary to a favorable result. Consequently the ultimate results in broken bones are not all that could be expected nor that we could desire. The same discontent is experienced by the patient and hence the frequency of suits for malpractice, which is the second reason for fracture patients being unpopular in the eyes of the physician. It is true that most of the suits are in the case of fractures of the larger long bones but the crippled fingers come in for their quota of dissatisfaction and law suits. A little more attention should therefore be directed to them. Although these fractures constitute only from 3 per cent to 4 per cent of all fractures, nevertheless they result often in deformity or dysfunction out of all porportion to the severity of the injury. Again the result in these infected compound fractures is all too frequently that of loss of the digit from necessary amputation.

In the consideration of these as well as other fractures a real knowledge of the applied anatomy is the first and most important feature. No one can understand why a typical deformity occurs or how to correct the same without this knowledge.

SURGICAL ANATOMY

Each digit has three phalanges. These include the thumb, for in development the proximal bone is a phalanx and not a metacarpal, by virtue of its epiphysis being at the base or proximal extremity as is the case in all other phalanges. The first and second rows of these bones have a concave surface on their palmar aspect to permit of grasping objects with security and comfort. The distal phalanx has straight lines on both aspects. These points should be borne in mind and taken advantage of in the treatment of certain fractures. The interphalangeal joints are constructed by a trochlear surface on the proximal and a shallow socket on the distal bone. These are held together by anterior and lateral ligaments, which probably accounts for the fact that sprain fractures occur more frequently on the anterior or palmar aspect except in the case of the distal phalanx. Dorsally the absent joint ligament is replaced by the extensor tendon which attaches only to the base of the distal and to the side of the middle phalanx. Here the bone fragment may be pulled close together with the avulsion of the tendon resulting in the so-called mallet finger on the palmar aspect. The head of the proximal bones forms the knuckle in flexion. The articulation is distal to this, the proximal one being ½ inch, the middle ¼ inch, the distal ⅛ inch distal to the knuckle prominence. The position of the palmar transverse furrows will indicate the articulation level. The first furrow is midway between the metacarpophalangeal joint and the articulation between the first and second phalanges; the two remaining furrows correspond to the position of the articular line.

ETIOLOGY

Direct violence is the usual cause of fracture in these bones. The automobile door is a frequent offender usually causing a crushed comminuted or "bursting" fracture of the distal end of the last phalanx.

Indirect violence such as may occur from a blow on the tip of the finger may result in a dorsal sprain fracture or, rarely, an

FIG 1. *A.* Comminuted "crush" fracture of distal phalanx resulting in disfiguring flattening of finger tip. *B.* Transverse fracture of distal phalanx, with but slight deformity.

epiphyseal separation with diaphyseal fracture, causing a "dropped" finger tip with loss of extensor power. In the other two phalangeal rows, indirect violence usually results in a fracture at the base of the bone. In the proximal and middle phalanges direct violence against their distal extremities often results in fractures of a longitudinal or long oblique nature. Occasionally the articular surface, usually the distal one, is fractured.

The base of the proximal phalanx of the first digit (thumb) is usually fractured by violence applied laterally against the extremity of the bone. It occurs most frequently in the fistiana sport, and is the direct result of the "haymaker" or "side swipe" against a hard portion of the opponent's anatomy, most often the head. For this reason it is commonly spoken of as the "sparring fracture." It is also termed the stave or Bennett fracture.

Many of the fractures are compound due to the nature of the trauma and the sub-

cutaneous situation dorsally. Crushed, industrial fractures are usually open and infected. Epiphyseal separations occur
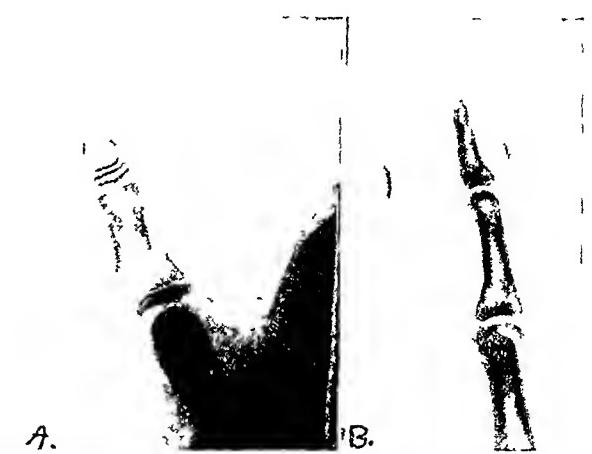
FIG. 2. *A.* Fracture into epiphyseal line. This fracture, as does epiphyseal separation, often has an associated rotation deformity. *B.* Fracture of trochlear surface of second phalanx involving joint.

occasionally but only in patients under twenty years of age. Torsion is frequently the cause of such injury, especially in the thumb, the result of twisting by another child while at play. Baseball injuries are usually in the nature of a fracture subluxation. Fissured fractures, especially of the distal phalanx, are not unusual. Except for crush fractures due to direct violence the proximal phalanx is the most frequently broken. Fractures of the digital tuft are often compound.

SYMPTOMS

Fractures of these bones differ but little in their symptomatology from fractures in other long bones. Pain, swelling, tenderness and some deformity usually are present. As a rule, the deformity is in the nature of a widening of the finger as well as lateral and *palmar* angulation, the latter being the more common. In the distal phalanx the widening is very pronounced as a rule. Overlapping deformity with shortening is rare because of the splinting by the supporting tendons. For this reason permanent traction is seldom needed, except in comminuted, open, infected

cases. Crepitus is usually present and easily elicited. Preternatural mobility is unusually difficult to elicit, because of the

Fig. 3. Two views of fracture of shaft of middle phalanx. Note deformity resulting in appearance spoken of as "bayonet finger." This deformity must be corrected, otherwise a crippling of grip of hand will result.

shortness of the bones and the multiplicity of joints in juxtaposition.

Diagnosis is seldom difficult. In all cases a roentgenogram should be made. The surgeon should bear in mind that the dressings preliminary to roentgenography should permit of separation of the digits when possible. Superimposition may result in erroneous roentgen-ray reports of the condition. In examinations of the digital tuft the presence of a secondary epiphyseal center must be borne in mind. Sesamoid bones are occasionally present and may cause confusion in a suspected joint fracture. The Bennett, stave or "sparring" fracture is all too frequently mistaken for a dislocation; the latter is a comparatively rare condition.

TREATMENT

All displaced phalangeal fractures are reduced by traction and manipulation, and later splinted by the type of dressing best adapted to maintain the proper position of the fragments. Individualized treatment applies here as in all other fractures. The tuft fracture may require moulding of the fragments into closer

approximation, thus correcting the unsightly flattening that would otherwise result. The fixation may be accomplished

Fig. 4. Typical deformity noted in Bennett or stave fracture at base of thumb. Note sesamoid bone which should not be misinterpreted.

by a small short wooden splint, hairpin, or cardboard fastened on the palmar surface by adhesive strips. This same dressing is applicable to all other fractures of this bone as well as to many of those of the second phalanx. For those of the proximal bone the palmar straight splint must extend into the hand, and be padded to fit the contour of the part. Occasionally the straight character of the posterior aspect of the phalanges and the metacarpal bone lends itself best to a posterior straight splint. Often better protection and fixation will be obtained if one or both of the neighboring digits be included in the dressing.

Many of these fractures, especially if multiple, or if the angular deformity is toward the palmar surface, as it so often is, will best be treated by binding the reduced fracture together with one or more other fingers around a roller bandage. A wooden ball has been used for the same purpose. Dressing in this flexed position tends to preserve the curved palmar surface

of the bones and at the same time it is the position of equilibrium of muscle pull. This is proved by the fact that the normal

shortening and bowing toward the radial side.

Open fractures, especially infected ones

FIG. 5. Hairpin splint.   FIG. 6. Posterior straight splint.   FIG. 7. Spica plaster cast for Bennett fracture.

position of relaxation of the four fingers is that of semiflexion. Observation of any-one's hand at rest convinces one of the truth of this statement. Very occasionally in multiple comminuted digital fractures the tennis racket or bango traction may be used to advantage. The Bennett fracture is best treated after reduction by a spica dressing of liquid glass, plaster of Paris or the stave splint well known to most physicians.

Lateral, rotary and palmar deformities must be corrected with meticulous care, the first two, to prevent unsightly deformity, and the third to prevent disability due to pain incident to pressure when grasping a hard object firmly. It is better to have a dorsal "lump" than a palmar one. This palmar bowing is most likely to occur in the middle phalanx. Joint fractures require accurate reposition. Should there be any question of ankylosis, a partially flexed finger is more useful and less inconvenient than is a straight one. All uncomplicated closed fractures unite kindly in two to four weeks, without excessive permanent callus. The Bennett fractures usually result in a permanent

involving the joint and tendons, are prone to give poor results. If seen early the wounds should be debrided and cleansed

FIG. 8. Roller bandage dressing. Note that adhesive strips do not press upon nails. Such pressure would be uncomfortable in a few days and result in irregular nail growth. Bandage absent for demonstration purposes.

with an antiseptic. If this can be thoroughly accomplished the wound may be loosely closed. Tight sutures will result in disaster. If the wound cannot be thoroughly cleansed or debrided it should be

left wide open. From an economic stand-point of time lost, in cases of sloughing tendons and ankylosis with a resultant crippled finger only, after weeks or months of suffering, amputation is best. This, however, should be advised only after serious deliberation. The thumb and index fingers are the most important to preserve in toto.

Massage and baking are indicated early. Active exercise in the nature of grasping compressible objects such as a crumpled handkerchief or a rubber bulb or ball is desirable.

The fingers are extremely important in a patient's life. Stiffness, ankylosis and permanent deformity may result in loss of ability to continue his livelihood. These fractures may be "minor" from the standpoint of the surgeon but they are often "major" from the viewpoint of the patient.

THE CARBOLIZED SCALPEL & POSTOPERATIVE ILEUS*

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THE CARBOLIZED SCALPEL

TISSUES, even deep ones such as the pleura and the pouch of Douglas, can be painlessly incised with a sharp scalpel, previously dipped in *pure* phenol (carbolic acid).

TECHNIQUE

A dry, sharp scalpel is dipped in pure phenol. The point of the back of the scalpel is passed over the intended line of incision, so as to mark it with the phenol. A few seconds later the scalpel is dipped again in the phenol and the tissues are incised very slowly and gently, the scalpel being moved up and down as in cutting with a saw. When blood appears, a sponge or blunt retractors are applied to the tissues, if necessary. The scalpel is dipped in pure phenol as often as required. The repeated dippings of the scalpel in phenol are required in order to deposit on the blade a film of phenol, which, coming in contact with the tissues as they are cut, anesthetizes them. This film is rubbed off, however, by the tissues or washed off by the blood through which the blade passes, and therefore has to be renewed by dipping the scalpel in the phenol as often as necessary, according to the depth of the tissues to be incised.

In order to prevent burning of the skin surrounding the incision, either during or immediately after the incision is made, the skin is swabbed with a sponge soaked with alcohol. The incision should always be *very small*, a large incision is never necessary.

Painless incisions are obtained with the carbolized scalpel because the film of *pure* phenol deposited on the blade comes in contact with the tissues while they are cut. Thus by the combined anesthetizing and cauterizing action of the phenol the sensory fibers incised become anesthetized. The smarting sensation, more or less painful, which follows incisions made in the ordinary manner, is absolutely absent when the incision has been made with the carbolized scalpel.

Self draining incisions are obtained with the carbolized scalpel. This expression needs a word of explanation. The film of phenol deposited on the scalpel obviously cauterizes the tissues with which it comes in contact, i.e., the edges of the incision.

The tissues thus cauterized will not adhere to each other as readily as if they had not been cauterized. In this fact lies perhaps the greatest advantage of the method. Because of the fact the cut edges will not readily adhere, the wound will remain patent for a certain length of time. Thus when a collection of pus is present, the pus will ooze out through the open wound *without the help of any means of drainage.* Henc the expression "self-draining incisions."

Sterile Incisions. It is obvious that incisions of whatever size made by means of the carbolized scalpel are absolutely sterile. The skin does not need to be disinfected previous to incising.

USES AND ADVANTAGES

The carbolized scalpel is the ideal method of treatment for collections of pus. I might state that one will be most pleasantly surprised to see how little attention is required to obtain a complete cure in a seemingly miraculously short time of collections of pus, which previously required frequent dressing, changing of

drains, painful manipulation, sleepless nights. Thus the treatment of cellulitis in any part of the body: abscesses of the pouch of Douglas, bartolinitis, bubos, perianal abscesses, peridental abscesses, infected glands, removal of infected foreign bodies, etc., becomes only a simple matter of *a very small* incision made with the carbolized scalpel. *No drain is ever necessary, no drain should ever be used.*

At the time of the most serious epidemic of influenza during the war Professor Buschi of Como and the writer treated more than 100 cases, some of which were in a moribund condition, of empyema thoracis by a simple intercostal incision made with the carbolized scalpel, with the most gratifying results.

The advantages of the method are self evident: It can be used in all cases, even when patients are moribund. It can be used in the most inflamed and infected tissues, where local anesthesia would be impossible and general might be contraindicated. It is the safest method of treating collections of pus, there being no danger of absorption of anesthetizing drugs. It is the only really entirely painless method. It is the cheapest from the standpoint of material used and especially from the economic point of view that the patient is disabled only a very short time, miraculously short when compared with the time required by other methods. It is the most esthetic, because only a very small incision is required, the cut edges of which, not being traumatized continuously by drains, heal promptly and practically without visible scar (this factor is really vital when pus has collected on face or neck). It is the method that frightens the patient the least, as no long and painful maneuvers and fear-inspiring instruments are required.

One word about the sterile incisions. We do not, obviously, advocate or recommend the use of the carbolized scalpel for exploratory incisions. However, there are indications for a very small 100 per cent sterile incision. So when absolutely sterile blood is desired, or previous to introducing the needle for spinal analgesia, we prick the skin with a sharp-pointed carbolized scalpel and push the needle through the nick thus made in the skin. In this manner the needle cannot possibly carry within any infectious material that might happen to be on the skin.

I do not report special cases, because the list would be too long. Suffice to say that the method has been used for the last twelve years in thousands of cases, always with complete satisfaction and that it can be applied by anyone with a minimum of surgical skill.

PREVENTING POSTOPERATIVE ILEUS BY STRETCHING THE ANAL SPHINCTERS

Ileus, one of the most common and severe postoperative complications, can, in many cases, be completely prevented, or at least made less troublesome, by the systematic dilatation of the anal sphincters at the time of operation. The dilatation should be made gently and should produce as complete a relaxation of the sphincters as is obtained previous to radical hemorrhoidectomy.

In cases where local anesthesia is used for the operation, the sphincters are stretched, after having anesthetized the anal region. In some of these cases the intraperitoneal organs, especially the small intestine and the transverse colon, must undergo, of necessity rather extensive handling. Although, even in these cases which could be called extreme, I did not notice any ileus, I do not intend to give the impression that I believe the abdominal organs can be traumatized with impurity provided the anal sphincters are dilated at the time of operation. On the contrary, I believe that they should be handled as little and as gently as possible, and that the first requisite of the abdominal surgeon is to know how to deal kindly with the intra-abdominal organs without abusing them with hands, fingers, retractors, gauze or other traumatizing agents.

This procedure has been adopted as routine in all my laparotomy cases for the last nine years. Nurses handling cases operated upon by several surgeons who did not stretch the sphincters always remark the absence or mildness of gas pain in cases operated upon by the writer; there could not be a better endorsement for the procedure.

The systematic stretching of the anal sphincters as an aid to prevent post-operative ileus seems to me to be based on sound physiopathological grounds. I do not intend to enter here into a discussion of the complicated and still obscure mechanism of intestinal peristalsis. However, I think it worth while to mention that the latest studies, especially by Bayliss and Starling and Friedlander, have demonstrated that excitation of the branches of the vagus ending in the celiac ganglion strengthens peristalsis; that the vagus exercises an inhibitory influence on the celiac axis similar to the influence it exercises on the heart; that the celiac ganglion receives from the splanchnic fibers impulses which paralyze the intestine, slowing down its movements until they stop completely; that the vagus inhibits and regulates the influence of the splanchnic fibers, so that if the vagus is stimulated the inhibitory influence of the splanchnic fibers is removed and the peristaltic waves start again. In this manner we can explain the formation of ileus not only after a direct operation on the intra-abdominal organs, but also the existence or aggravation of the same in cases of shock, renal and hepatic colic, strangulation of testicle and of epiploic hernias, torsion of pedunculated cysts and tumors, etc., and the great influence that direct trauma, hemorrhage, infection, etc., have in producing and aggravating ileus.

It follows that if the intestine is slightly paretic and gas forms in its lumen, this gas will stimulate the sympathetic impulses and establish a vicious circle, because the more gas accumulates the more pronounced is the excitement of the sympathetic system and consequently the more pronounced its inhibitory influence on the movements of the intestine, with resultant more or less complete paralysis of the same, which means ileus. This condition is aggravated by the fact that while the intestine lies more or less inert, the anal sphincters are contracted and prevent the escape of gas. Stretching of the anal sphincters relaxes the muscular fibers forming the sphincters, so that they are put in a paretic condition, absolutely unable to contract and oppose any resistance to the escape of gas.

Let us see what this condition means: The intestinal musculature, at the time of operation, even when the intestine has been severely traumatized, has not lost yet completely its power of contraction; gas, however, might begin to form, but cannot accumulate because the only obstacles to its exit, the anal sphincters, are completely paralyzed and cannot oppose any resistance; the early easy exit of the gas from the intestine prevents its accumulation, and, therefore, removes a strong factor of excitation of the sympathetic system which would not only act continuously, but the action of which would obviously become more pronounced as time passed. When the sympathetic system is not excited by the accumulation of gas, it has the opportunity to recover from the excitement suffered during the operation, and as the action of the vagus is not hyperactivated, it can more easily start normal peristalsis and prevent or minimize ileus.

I believe that stretching of the sphincters, being quite a simple procedure, should be resorted to in all cases of laparotomy or when ileus is present for any reason, because its beneficial action seems logical and there are practically no contraindications to it.

PERIANAL & PERIRECTAL SUPPURATIONS[*]

MARTIN L. BODKIN, M.D., F.A.C.S.

BROOKLYN

PERIANAL and perirectal infections or suppurations are classified as anal, ischiorectal, retrorectal and superior pelvirectal abscesses. They are all phases of infections found in this anorectal region designated to mean the collection of pus. The pus extends or burrows along the lines of least resistance between planes of fasciae and blood vessels which are able to resist dissolution. Abscesses which are not incised extend until they reach either the skin, mucous or serous surfaces through which they discharge their contents. A collection of pus within the ischiorectal fossa will find its way along the lower surface of the levator ani and discharge itself between the internal and external sphincters, a weak point in the anal canal. An abscess may discharge its contents through the rectal wall and the skin, forming a complete fistula. A fistula necessarily begins as an abscess, simple in its onset, but may burrow and rupture at different points, causing a complicated fistulous tract. Therefore, it will be seen that abscesses in this region are necessarily forced to pursue a definite course which is changed by the relations of the original site of the abscess cavity to the surrounding planes of tissue and blood vessels.

The different sites of primary collections of pus in this region are divided into superficial and deep abscesses, dependent in most instances upon the division made by the levatores ani muscles. We may have abscesses which have their origin in the urethra, Bartholin's glands, the prostate gland, or the bony structure of the pelvis, which burrow into one or both ischiorectal fossae.

Infection may occur through either the lymphatics or the blood stream carrying bacteria from the surrounding tissue; or locally from ulcers, fissures, thrombotic hemorrhoids, tears (of the mucous membrane), or from degenerated growths in the rectum. Males at the age of thirty seem to be more commonly afflicted with rectal abscess formation. The most frequent sufferers are persons whose resisting power and vitality are lowered from acute or prolonged chronic diseases. Influenza and tuberculosis, due to their depressing effects on all the bodily functions, permit invasion of the perianal and perirectal tissue with intestinal bacteria. The bacteria found in these abscesses are single or multiple varieties of the Communis coli, Streptococcus pyogenes, Staphylococcus pyogenes and tubercle bacilli. Specific infection may also be present due to erysipelas, typhoid or syphilis. The deep abscess is of the phlegmonous type which may become gangrenous with necrosis and diffuse sloughing of the contiguous tissue. The anal abscess is the result of an infection of the follicles, the same in every respect as furuncle or acne found in any portion of the body surface.

The subtegmentary abscess is a lymphangitis and simply an infection carried through the lymphatics.

The subcutaneous and submucous abscesses are due to infection as a result of a lesion in the anal canal or rectum. The infection is carried from the anal or rectal region through either the lymphatics or blood vessels into the cellular tissue, later causing a circumscribed abscess.

ISCHIORECTAL ABSCESS. This is the result of an invasion by bacteria of the ischiorectal fossa which is an easily invaded region. The loosely connected fat and deficient blood supply of the ischiorectal

[*] Submitted for publication February 27, 1929.

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fossa render its resisting power extremely low, and when infection is carried within its tissue the result is a very rapid abscess

during defecation, as the attachment of the anococcygeal ligament to the external sphincter muscle and the incomplete attach-

FIG. 1. *A.* Ischiorectal abscess. *B.* Submucous abscess.
(From Bodkin's "Diseases of the Rectum." E. B. Treat & Co.)

formation. The resistance to bacterial infection is so low that the tendency is, as a rule, to involve the entire cavity of one or both sides. Extension is impeded fortunately by the strong resistant tissue in the form of fasciae and muscles. The most common point of exit for these abscesses to discharge into the rectum is at the junction of the internal and external sphincter muscles. The extension of pus to the opposite side of the rectum is also made possible by the weak point at the junction of the levatores ani and the upper surface of the anococcygeal ligament. This weakness, which permits rupture of the abscess into the rectum at this point in the barrier, is supposed to be due to prolonged straining

ment of the levatores ani muscles form a fixed point which under severe strain at defecation becomes weak and separates the tissue. The separation of the tissue permits infection of the fossa. The trauma from strain is frequently the cause of fissure and the site of a fistulous opening, the result of abscess formation in the fossa. An abscess will very often burrow down through the separation between the outer and deeper fibers of the external sphincter muscles where the longitudinal muscle fibers of the rectum pass through to their skin attachment. A complete fistula may be formed when an abscess follows the course of these fibers. In this manner pus may completely surround the lower part of the rectum, dis-

charging in the median line posteriorly, after an invasion of both ischiorectal fossae, at the weak point formed at the junction

rectal abscess is very often associated with retention of urine and a sensation of weight in the rectum which is relieved by its
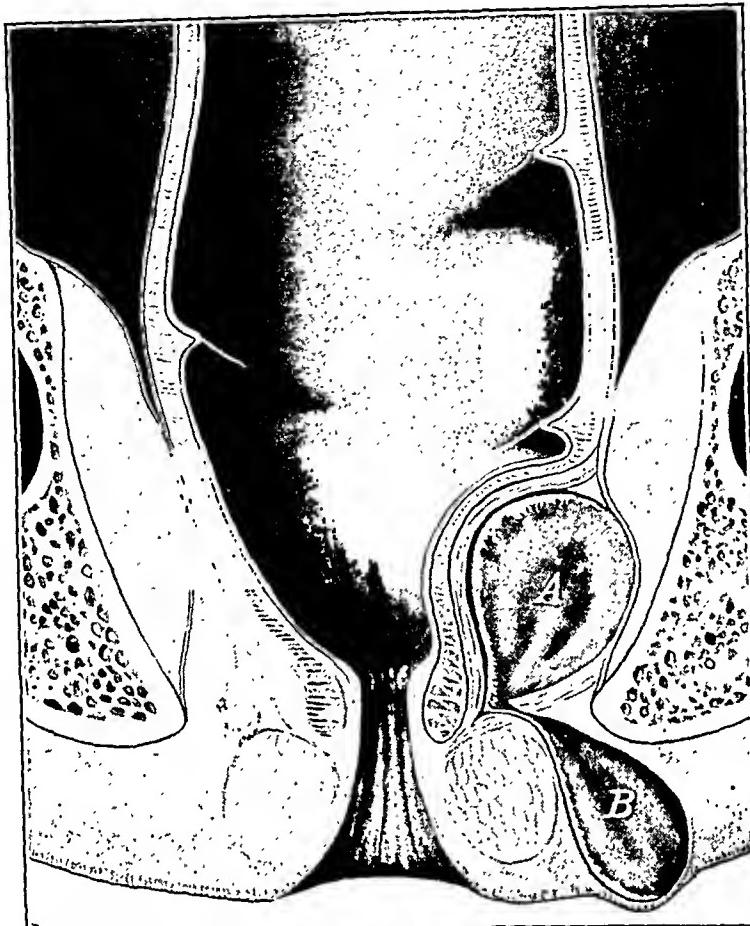
FIG. 2. Rectal abscesses. *A*, Pelvirectal abscess. *B*. Terminating in ischiorectal abscess. (From Bodkin's "Diseases of the Rectum," E. B. Treat & Co.)

of the levatores ani and the anococcygeal ligament.

Abscesses which have their origin in the ischiorectal fossa anterior to an imaginary transverse median line, drawn from right to left, are more superficial in their course than those starting posterior to that line.

Symptoms. The general symptoms are the formation of pus such as occurs with ordinary abscesses. There may be a chill, rise in temperature, quickened pulse and pain varying in degree according to the location and extent of tissue involved. The anal, tegmentary, and subtegmentary abscesses being so superficial may be marked by hardly more than itching, redness and discomfort in sitting. The ischio-

spontaneous discharge into the rectum. Should the abscess cavity refill the symptoms recur with the exception of the retention of urine. Very often these abscesses, when not properly treated, refill repeatedly at periods for years.

Treatment. The superficial tegmentary and subtegmentary abscesses yield readily to the application of lysol, or carbolic acid neutralized with alcohol. It is much more satisfactory to incise the subcutaneous abscesses, when they have burrowed, under local anesthesia. The incision should be т-shaped with the top of the т toward the anal opening, to afford free drainage and to insure granulation from the deepest portion of the wound.

The ischiorectal abscess requires incision over the abscess and through the external sphincter to drain the cavity in order to

care should be exercised to avoid penetrating the peritoneal cavity. Bleeding is usually quite free after a primary incision
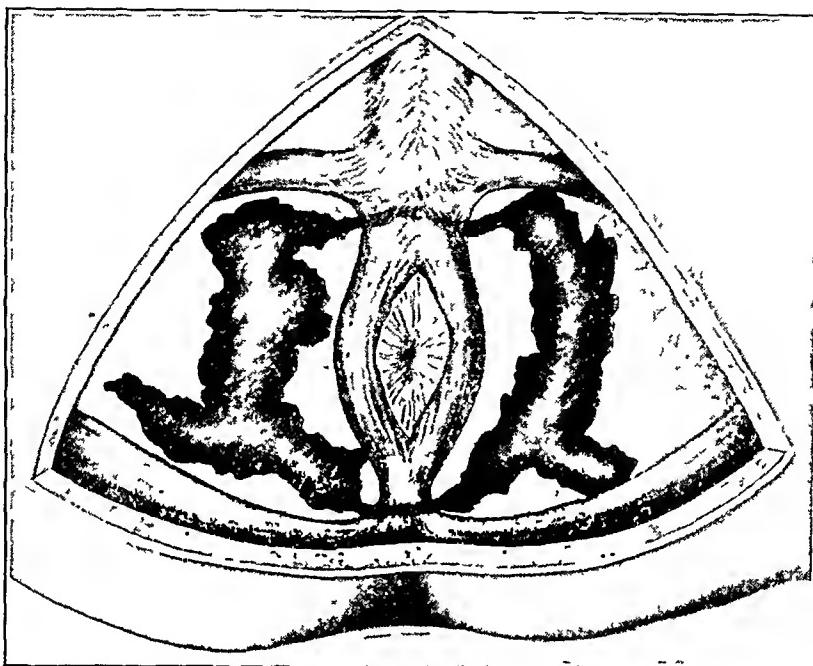
FIG 3. Horseshoe fistula, result of pelvirectal abscess.
(From Bodkin's "Diseases of the Rectum," E. B. Treat & Co.)

make a wide open wound. The T-shaped incision is advised for this purpose also but reversing the T so that the top of the T is over the abscess cavity and the bottom of the T cuts through the external sphincter muscle into the anal canal. The wound should be irrigated with water and curetted lightly. The cavity should be cauterized with lysol or carbolic acid which should be neutralized with alcohol and then packed with plain gauze to be left in position for two days. These abscess cavities are best treated without further packing. The submucous abscess requires often the dilatation of the sphincter muscle and therefore requires the use of a general anesthetic. An incision should be carefully made parallel to the long axis of the rectum through the entire length of the abscess in order to prevent later the accumulation of pus in a poorly drained pocket. Should the burrowing extend for a distance of more than 3 inches upward on the rectal wall, great

of the submucous abscess and requires firm packing with gauze.

PELVIRECTAL AND RETRORECTAL ABSCESSES. The pelvirectal abscess results from infection of the loose connective tissue situated between the levatores ani below and the peritoneal wall above, in the portion of the pelvic cavity known as the superior pelvirectal space.

The retrorectal abscess has its origin in the connective tissue between the sacrum and the rectum posteriorly.

The connective tissue of the pelvirectal space is part of the common tissue of the mesorectum in the male covering the prostate gland and neck of the bladder, and in the female within the broad ligaments.

Infection of the superior pelvirectal space may be carried through the lymphatics or blood vessels from adjacent pelvic disease, rectal operations, or sepsis during the puerperium. The pus may pass downward and penetrate the separated fibers of

the levatores ani at the junction of the levatores ani and external sphincter muscles posteriorly, forming an ischiorectal abscess also. There abscesses are always a serious condition and the prognosis is variable and dependent upon the original source of the infection. A diffuse cellulitis may be followed by peritonitis should the pus burrow into the general peritoneal cavity. A deep posterior or anterior horseshoe fistula or a rectourethral fistula may result from these diffuse infections of the pelvirectal space. The posterior horseshoe fistula is more commonly the aftermath of the pelvirectal abscess.

The symptoms of pelvirectal abscesses appear suddenly and are masked by the complications of the original site of infection which may have been located in a neighboring organ for a long time.

If the abscess points into the ischiorectal fossa, the treatment is the same as for the uncomplicated ischiorectal abscess. To ameliorate symptoms, incision of the abscess should be made at once.

The origin of the infection should guide the further treatment and may require the vaginal incision of a pelvic abscess or, exceptionally, an abdominal section. Should the incision be carried higher that the levator ani muscle, the wound must be packed tightly for a few days to avoid severe hemorrhage. However, the incision should not be made through the internal sphincter, otherwise incontinence will result.

AFTER-TREATMENT. The subsequent treatment of incised abscesses in the rectoanal region is often more important than the primary incision. The primary incision may be the best method for the immediate relief from pain and suffering, but will not afford freedom to the patient from the discomfort and misery of a pro-

tracted fistula discharging itself from the former site of suppuration in the pelvic or rectal region. Failure to cure these patients may be attributed to a lack of knowledge on the part of the surgeon, or to his inability to impress upon the patient, at the beginning of his professional care, the great necessity of after-treatment. It is best to insist upon frequent treatments at intervals of two or three days, until the fistulous tract is healed. Usually a pelvirectal or ischiorectal abscess will require from eight to ten weeks to bring about a successful termination. Ichthyol, argyrol, silver nitrate, tincture of iodine or balsam of Peru are commonly used to stimulate granulation. Nitrate of silver is best suited for the tubercular types. The very free use of plain sterile warm water has proved a most efficient cleansing agent.

The pus from an abscess in this region should be submitted for examination by the bacteriologist in order to rule out the possibility of tuberculous infection. It has been my misfortune to find unsuspected cases suffering from a tubercular infection. The application of the actual cautery when practical, or the use of nitrate of silver as a routine treatment is protective. This procedure tends to destroy the tubercle bacilli without extensive destruction of the underlying tissue. The barrier nature has previously built up around the abscess and fistulous tract, to protect the patient from further infection, remains undisturbed.

In the after-treatment of these wounds, one should thoroughly dilate with the fingers in order to break adhesions at the sides which leave areas higher up unhealed. The granulating process must be forced to advance only at the extreme bottom of the wound so as to prevent the formation of a fistulous tract covered by healthier surfaces nearer the skin.

FOREIGN BODIES IN EAR & NOSE*

George L. Richards, M.D., F.A.C.S.

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ALL children tend to put small objects in the mouth about as soon as they can handle anything. The reason is evident since the mouth is the young child's organ of information as to the character of external objects.

Older children have a tendency to put foreign bodies in the ear and nose as well as in the mouth. The reason for this is not quite as clear but possibly is due to the child's habit of feeling the skin with various objects, especially smooth ones.

FOREIGN BODIES IN THE EAR

The foreign bodies placed in the ear consist of any small objects which a child can handle and which may be put in the ear. Common ones are peas, beans, beads, small pieces of stone, bits of rubber, chalk, pieces of nut, pencil tips, bits of cotton, bits of wood and the like. In addition and more often in older persons flies and other insects occasionally make their way into the external ear canal.

Sudden deafness in children, pain limited to one ear without apparent cause or inflammation with or without a history should make one think of the possibility of a foreign body and an examination should be made. In young children both the examination and the removal may be difficult on account of the fear of the child that he is going to be hurt.

A foreign body in the ear canal is seldom an emergency and no attempt should be made at removal until prepared to cope with any situation which may arise. Take time to get ready for its removal if there is any likelihood that it will be at all difficult. Children do not hold still for work on their ears and are frequently very much frightened before anything is done. All the procedures for the removal requir   a quiet patient and are usually done under a reflected light. If it is found that the child is restless, fearful and will not remain quiet it is better to give at once and before any manipulation a general anesthetic.

Good illumination from a forehead mirror or from some source of electric illumination or clear daylight is essential. If the foreign body is deep in the canal reflected light is absolutely necessary. A good-sized ear speculum, a plunger syringe with small tip or a small soft rubber syringe, two small wire curettes, one with smooth edges, the other sharp, and bent at a slight angle on the shaft, an ear spoon, such as was formerly in every physician's pocket case, a small short hook at nearly right angles to the shaft, and ear forceps are the instruments required. There are two types of ear forceps, the small angular type made so as to be opened as widely as possible in the canal and the Sexton type with parallel blades. The forceps are only to be used when the object has been drawn far enough forward to be readily grasped. No light ear forceps will hold the foreign body if it is firmly packed within the canal.

The first examination is to ascertain the position and nature of the foreign body and how long it has been in place. If very recent, attempt to remove at once. If it has been present for some time and the canal is swollen wait for this swelling to go down, as much harm can be done by ill-advised attempts at removal. The ear canal readily bleeds if traumatized even slightly and this bleeding is often very persistent and masks the foreign body, hence every care must be taken to prevent this bleeding.

If the object is small and not too tightly packed it can usually be removed by syringing. Use plain warm water or warm water and boric acid and lifting the auricle

upward so as to straighten the canal as much as possible, direct the stream backward along the ear wall so as to get the water behind the object. If it is a pea or bean or anything that can swell it may be so swollen that the water cannot get behind it. Here the spoon-shaped instrument or the small curette or hook may serve excellently. If the child is quiet these instruments can be slowly worked around and behind the object. Do not use force from below upward but on the anterior and posterior and upper sides of the canal since if the object is at all deep, by working from below it might be possible to push the object into the middle ear cavity and then into the attic. This has happened. In such a case the extraction becomes very difficult and should be done by one trained in aural surgery. In using the syringe a considerable degree of force is required as it is the pressure of the water behind the object which is going to remove it. In using the short hook always introduce along the side of the canal in such a way as not to traumatize the canal. Kerrison has invented a ring curette which can be introduced along the canal and behind the object and then brought to any angle up to a right angle; it is smooth and does not traumatize. It has the possible disadvantage that it has to be so small that it cannot be made strong enough to bring any appreciable pressure on the object and is not as practical as the small ring curette firmly attached to a small straight handle.

A glass bead is very difficult to remove if impacted but if it has a center hole it may be possible to so manipulate it as to get the short hook into the lumen of the bead.

If unable after proceeding in this manner to remove the foreign body and if it is firmly impacted deep in the canal the patient should be sent to a capable aurist. In such a case the posterior membranous canal wall is detached and brought forward as in the radical mastoid operation. The foreign body can then be gotten at from behind and brought forward and removed under good illumination. The wound is then sutured, the canal lining carefully replaced and held in place by a gauze pack for a few days, Healing is prompt and usually without incident.

Insects are best removed by syringing. They are very annoying, especially the buzzing kind. Simple syringing may be tried and if they do not come out readily they should be killed with oil or chloroform before further attempts at removal. Flies have even laid their eggs in the ears and maggots have formed there. Do not attempt to remove a fly with forceps even if visible. The insect will be hard to grasp and there is danger of doing injury with the forceps.

Removal of Cerumen. Many people suffer from hardened wax in the ear canal and the technique of its removal, while as a rule simple, may be difficult of accomplishment. The reason is that the ear canal is sometimes irregular and narrow at the junction of the membranous and bony portions. The wax becomes hard and attempts by the patient to remove it with the finger only force it more deeply into the canal.

Patients often complain after sea bathing of what they call "water in the ear" when the real trouble is due to water in the external canal which has caused swelling of hardened wax, and the deafness and discomfort that follow are due to pressure of this wax against the drum.

For removal of cerumen a solution of bicarbonate of soda (a teaspoonful in a bowl of warm water), a syringe and a small smooth wire ring curette are all that are necessary. The bicarbonate of soda will soften the wax sufficiently if the wax is not too hard. If the wax is very hard it may be softened by packing against the mass a cotton pledget soaked in peroxide of hydrogen. Leave this in place for a short time and follow with syringing, repeating the peroxide if necessary until the wax is all out. Sometimes very rigid masses of cerumen which are resistant to syringing

can be removed by inserting the smooth ring curette alongside of the mass, which may then come away as a whole without difficulty.

On the other hand, masses of cerumen are somet mes very difficult of removal and too long efforts should not be made at any one time. Instruct the patient to fill the ear with peroxide of hydrogen every morning for two days and then return. At the second sitting little difficulty will be experienced with removal. When the wax is all out the drum will be plainly visible. Inspect and dry the canal afterwards and be careful not to injure the canal or cause it to bleed as this bleeding has a tendency to continue and may be annoying.

FOREIGN BODIES IN THE NOSE

Pus discharge in the nose, especially if one sided and not readily explainable, should make one think of a foreign body as a possible cause. This applies to adults as well as children, though not as often. Children occasionally put foreign bodies in the nose which, not producing much trouble at the time, are unnoticed and may remain for years. I have twice removed metal buttons which had been present in the nose for several years. In one case relief was sought for an annoying one-sided discharge and in the other a diagnosis of nasal syphilis had been made and much medicine taken. Both cases promptly recovered when the buttons were removed. The foreign body if in place any length of time will be incrusted with lime salts and may be called a rhinolith. The objects introduced are as various as those introduced in the ear: peas, beans, buttons, beads, small stones of the street, pencil tips, shoe buttons, nuts, erasing rubbers, pieces of chalk, pieces of sponge, cotton tampons and so on. Nose bleed is not uncommon in childhood and adult life and any object introduced to stop this may be pushed far backward and may not be able to be removed by the person himself. It may even be forgotten and become lime incrusted and carried for a long time before relief is sought.

The symptoms are referred mostly to one side and are difficulty in breathing and often foul-smelling discharge. In children under seven years of age a one-sided discharge lasting longer than a week or two should suggest the possibility of a foreign body.

Reflected light and a quiet patient are essential for both examination and removal. A nasal speculum, spoon curettes, preferably smooth edged, a long silver probe, cotton applicators, a stout toothed nasal forceps with a long blade and scissor handle, and a syringe are the instruments required. If the object is irregular a snare may be helpful. Cleanse and cocainize the nose first of all and use adrenalin or some such substance to contract the tissues. If the supposed foreign body is not readily seen examine carefully with the long silver probe. This will usually reveal its presence and position and give information as to its character.

Syringing may be used but there is the danger of pushing the object further backward. It is most efficient when used through the opposite nostril but much force cannot be used on account of the danger of forcing water into the ear. The forceps and short hook on a long shaft and smooth-edged curettes are the most useful of the instruments. If the body is round like a bead it is safest to put the forefinger of the opposite hand in the nasopharynx so as to avoid any possibility of the foreign body going down the bronchi; this is especially necessary if an anesthetic has been given.

The question of anesthesia must be considered in each individual case. It is better to give an anesthetic than to struggle with a frightened or unruly child who is afraid, and often with good reason, of being hurt.

COMMON DISLOCATIONS*

KELLOGG SPEED, M.D., F.A.C.S.

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FOLLOWING the great development of the automobile as the dominant factor in human trauma, statistical studies of dislocations have been discarded. So varied are the resulting blows, crushings, and twistings of automobile accidents to pedestrian and passenger that dislocations are seen by every physician. In relative order of occurrence they may be listed as dislocations at the shoulder 60 per cent, elbow 6 per cent, hip 5 per cent, knee 3 per cent, thumb, jaw, wrist and ankle between 2 per cent and 1 per cent of all dislocations. True wrist and ankle dislocations are very rare; they are nearly always accompanied by fracture; in fact every ankle fracture involves more or less dislocation but fracture must be considered primarily at that point.

In the diagnosis of common dislocations the paramount feature is rigidity of the joint and part involved—very different from fracture which usually leads to increased or unnatural mobility. Either may be accompanied by pain and interference with function, but the acutely dislocated limb is so painful that any attempts to test the rigidity are met by powerful protests on the part of the patient. It is really inhuman to attempt to feel crepitus in differentiation between fracture and dislocation when our most valuable adjunct for diagnosis, roentgenrays, is available everywhere. The use of roentgen rays is absolutely necessary to establish the diagnosis and the extent of the pathology. A fracture complicating dislocation can thus be ascertained and the possibility of manipulative reduction or the necessity for other steps in treatment decided upon.

The treatment of common dislocations may be briefly stated: First, examine superficially for evidence of real nerve or blood vessel injury and record in writing at once; then obtain roentgenographic confirmation and determine the extent of the injury, including accompanying fracture. Reduction must follow as soon as possible. The sooner proper reduction is accomplished the less one may expect a complication and difficulty in reduction. A general anesthetic is required almost always for manipulative reductions. In the case of the larger joints the patient should be taken to a hospital if possible. Always in case of shoulder and hip dislocations one must be sure that anesthesia is carried to a stage of complete relaxation; there will be less secondary tearing of joint capsule or other malicious damage. All manipulative reductions must be gently performed; force avails little, is amateurish and damaging. If gentle efforts fail, desist. Do not hesitate to call for consultation and help from a colleague. Manipulation takes advantage of untorn parts of joint capsules and muscles attached to the bone. It depends on leverage action and permits a natural guiding help of the untorn parts about the joint.

Continuous traction may also be used to pull a joint back into normal position. This method does not require general anesthesia. Either a small amount of local anesthesia injected about the joint or none at all is used. The limb is put in traction in the axial direction which will lead to reduction and as the pull is maintained for some time, the spastic muscles loosen and the part gently returns to a normal position. Gravity can thus be used as the active reducing force, especially in dislocations at the shoulder.

After hip dislocations frequently the greatest errors in treatment are on the part of the person attempting a reduction, even the physician. Usually the anesthesia

* Submitted for publication February 23, 1929.

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is not complete; efforts at reduction are started before there is full relaxation of all muscles about the hip joint. Muscular spasm is caused and the attempts at reduction fail, leading to repeated and often forceful or wild efforts. Complete deep anesthesia must be obtained first. A second error is for the reduction to be attempted while the patient lies on a table, usually an operating table, the surface of which is too high for the average physician to manipulate a leg with steadiness and power. If all patients with dislocations of the hip could be thoroughly anesthetized and then laid gently on the blanketed floor, reduction would usually follow at the first attempt, often simply from flexion of the thigh on the trunk followed by gentle outward rotation of the leg as the physician bends over the patient. If this method fails the patient lies in the most favorable position for the use of Allis' method, i.e., lifting the thigh upward and gently pulling the head of the femur into the hip joint.

After reduction very gentle handling of the limb is necessary. One must make sure that the peripheral blood and nerve supplies are intact and in most instances a splint or bandage is required to hold the parts in relaxation to permit healing of the joint capsule. Always obtain a post-reduction roentgen-ray examination. An undiagnosed fracture may then be found which calls for further treatment.

The prognosis for complete recovery after dislocation depends on whether or not anesthesia is used, the gentleness of the reduction, the thoroughness of the reduction as demonstrated by roentgen-ray examination and a proper period of post-reductive rest for complete capsule healing. Frequently firm joint capsule healing takes a longer time than bone healing after fracture.

Recurrent and habitual dislocations can be avoided largely by attention to these elementary points. Most shoulder dislocations require eight weeks' rest before full use, especially before abduction of the arm is permitted. A recurrent dislocation should always be a source of embarassment to the surgeon. The patient must keep the joint quiet until the joint covering will bear the brunt of motion without stretching or tearing open again.

It has always been the writer's habit to give the patient typewritten instructions after reduction of a dislocation. These vary with the joint involved. In the case of the common dislocation at the shoulder the patient is advised:

1. Not to raise the arm above a right angle to the thorax for at least two months after the dislocation.

2. All motions with the injured arm in dressing and bathing which involve reaching must be avoided for a similar period.

3. In crowds keep the hand of the recently reduced dislocation in the coat pocket.

4. Do not run to jump on a street car or any moving conveyance where the arm might be jerked.

RATIONAL TREATMENT OF BURNS*

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THE necessity for the prompt institution of rational methods of treatment for burns makes it desirable at this time to review the many methods in use. There is no existing perfect treatment, but from the consideration of the pathological physiology involved it is obvious that definite factors must be dealt with in order to justify the retention of any suggested method of treatment.

A burn is a wound caused by heat, light or chemicals. It differs from the ordinary wound in that there is usually a greater amount of tissue destruction. We speak of burns according to degree, but unless we use one standard classification, this method of description is confusing. The most satisfactory classification is that of Dupuytren which is as follows: (1) erythema; (2) blistering; (3) partial destruction of the skin; (4) destruction of the entire thickness of skin; (5) destruction of the subcutaneous tissue and muscle; and (6) destruction of the entire part including the bone. Such a classification places the depth of the burn at an anatomical level.

It is generally agreed that the extent of a burn is much more important than the depth, indeed burns of the first degree covering two-thirds of the body surface are frequently fatal. Burns of the second degree or greater involving one-third of the body surface are usually fatal. In children the margin is smaller than in adults. When may a burn be called serious? A reasonable suggestion is that a serious burn involves one-tenth of the body surface.

The changes produced by a burn are local and general. Locally there is a destruction of tissue. There is an inflammatory reaction of the zone between living and dead tissue in an effort to cast off the necrotic material as a slough. So long as the slough is present there is absorption going on of toxic products of protein decomposition.

The serious burn produces systemic changes which vary in intensity with the extent of the burn. These changes may be described in the two stages in which they occur. The primary condition is one of shock. The clinical manifestations of this condition are lowering of the consciousness, pallor, subnormal temperature, cold moist skin and low blood pressure with a rapid pulse of small volume. All deaths occurring in the first twenty-four hours are considered as being due to primary shock.

Beginning after twenty-four and usually before seventy-two hours the secondary stage manifests itself by delirium or coma, vomiting, high temperature and rapid pulse. At this stage degenerative changes are found in many organs. These changes are due to the absorption of toxic primary and secondary proteoses formed in the breaking-down of the devitalized tissue.

The most constant change is a degeneration of the adrenals. The liver and kidneys also show degenerative changes. The urinary output is decreased and albumin, red cells and casts are found in the urine. Blood studies show a concentration and the degree as measured by hemoglobin estimation may be used as an index of the toxicity. The blood chlorides have been found to be low and proportinate to the amount of tissue destroyed. Hemorrhagic areas are sometimes found in the mucosa of the gastrointestinal tract and rarely an ulcer is formed. When large granulating areas are formed there is a great loss of body fluid through these surfaces.

Burns heal finally by epithelization from

the periphery, the stratum germinativum, if it be intact, the epithelial lining of the hair follicles and skin glands, or from some form of skin grafting. Contractures are prone to develop in burns over joints and about the neck.

With an appreciation of the changes which occur in the burned patient it is a simple matter to formulate the requirements of a rational method of treatment. The primary shock must be treated; in so far as possible the secondary stage of toxic protein absorption should be prevented; toxemia must be dealt with when it developes; and locally a clean surgical wound is the goal.

Primary shock is treated by morphine in generous doses for relief of pain. External heat is supplied by warm blankets, hot water bottles or electric warmers. Saline or glucose is given intravenously or subcutaneously to make up the fluid volume. At this stage the margin of safety is very narrow so nothing is done that will in any way add to the serious state of the patient. The clothing need not be removed. The local condition is of secondary importance. When the pulse improves and the blood pressure rises, the clothing may be removed and local treatment instituted.

For the local treatment of burns a multitude of remedies have been used. Undoubtedly most of these are satisfactory in the minor burns, those which are not extensive enough to cause appreciable systemic changes. Warm moist dressings of boric solution or soda bicarbonate work well. Bland ointments such as boric are satisfactory. Picric acid in aqueous solution or combined with butyn in an ointment gives relief of pain. It must be emphasized however that symptoms of poisoning have developed from the use of picric acid over extensive burned areas. The application of paraffin in such combinations as ambrine has many supporters. This material is sprayed over the burn at a temperature just above its melting point. It gives relief from pain, splints the area and allows healing to go on under an airtight coating.

All of the above methods of treatment should be used under aseptic precautions and after careful debridement and puncture of blebs.

It is in the case of the serious burns, those especially in which the margin between life and death is narrow, that we must use a treatment which is based upon an appreciation of the pathological physiology which was discussed earlier. Our treatment must aim for these principles; diminution of toxemia, asepsis, relief of pain, prevention of fluid loss and the prevention of deformities. Some years ago in an effort to reduce the toxemia many burns were treated by radical excision of all the necrotic tissue and of course a great deal of viable tissue was removed with the dead. This method was found to be very shocking in patients who were always poor surgical risks.

As a substitute for excision there has been developed by Davidson the tannic acid treatment. The object of this therapy is to fix the destroyed protein by chemical means, rendering it unabsorbable. Moreover, tannic acid, which is a mild antiseptic, gives rapid relief from pain, has no effect upon living tissues and forms a dry crust which retains body fluids and permits healing to progress beneath.

The great popularity of this treatment is well deserved, being founded on a rational basis, and clinically producing a decided drop in the mortality rate in a large series of cases.

Tannic acid is used in a freshly prepared 2 or 3 per cent aqueous solution. It is applied by saturating the gauze dressings over the burn, or by spraying directly over the exposed burned areas at frequent intervals. The surface is first cleaned with saline or boric acid solution and gross particles of dirt removed. From eighteen to thirty hours after the application has started the burned area assumes a mahogany brown color. Then the process of tanning is complete. Dressings are removed and the surfaces exposed to dry heat, best with an electric baker over the bed. There

is then a wound covered by a dry crust; it is relatively insensitive, an unfavorable place for bacteria to develop and demands no tedious painful dressings.

Beginning in six to twenty days, according to the depth of the burn, the crust begins to separate. Epithelization may go on under the crust from the remaining viable cells of the germinating layer, hair follicles or skin glands. In the deeper burns a granulating area is present which is ready for skin grafting.

Occasionally infection occurs beneath the crust during the tannic acid treatment. This condition manifests itself by fever, redness about the periphery, and tenderness over the crusts. Without delay the tanned material should be excised and a dressing saturated with 1:5000 acriflavine applied.

The prevention of contractures should be constantly kept in mind and if necessary splints should be applied to the extremities.

During the first five days, systemic treatment is pushed to lessen toxemia. Fluids are forced, and saline is given subcutaneously to keep up the blood chloride level. Blood transfusions are of great value at this stage. The degenerative changes which occur in the adrenals would seem to warrant frequent small doses of epinephrine.

SUMMARY

Minor burns may be satisfactorily treated by several methods which relieve pain and allow healing to progress under aseptic conditions. In the burns of serious extent general treatment must be instituted for primary shock and toxemia. The local use of tannic acid has diminished the amount of toxic absorption and produced a type of wound which is dry, insensitive and aseptic. Because of these facts and the reported decrease in mortality since the introduction of tannic acid, this is the treatment of choice in all serious burns.

SPRAINS AND INJURIES OF FINGERS AND TOES*

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RALEIGH, N. C.

SPRAINS are nearly always treated by one of two general plans. The first, chronologically speaking, may be

FIG. 1. Banjo splint for injuries to fingers.

called the rest-heat-massage-treatment, and the second the support-and-use treatment. Experience has taught us that the second plan, used intelligently, gives quicker and better results, and fits the requirements of industrial surgery. On the other hand, the rest-heat-massage treatment is more comfortable and for a clientele more elite than ours (whose comfort is more important than their time) may serve the purpose better.

In the support-use treatment one must give enough support to protect the injured ligaments and not so much as to impede unduly the use of the part. Take a sprained ankle, for example: A few strips of adhesive plaster extending an inch or 2 above the ankle cannot give any material support to that joint. Adhesive should be used freely; a stirrup of adhesive extending up to knee joint on both sides of the leg forms the foundation strapping, while additional criss-cross straps are used for reënforcement. On the other hand a plaster cast is too much; it impedes the use of the part and prolongs convalescence as in the rest-heat treatment. In treating sprains of any part of the body, the same general principles hold good. It is, of course, important to be sure of the diagnosis; nothing is more embarrassing than to have a sprained ankle turn out to be a Pott's fracture.

Injuries to Fingers and Toes. If any statistics were available—(which they are not to me). I have no doubt that injured fingers and toes would be found to blame for a large part of the time lost through industrial accidents. In the first place they are always getting hurt and in the second place they frequently do not get the respectful treatment they deserve.

An infected wound in a finger may cause as much disability as an infected wound elsewhere and the same care should be taken to prevent infection. Fractures of metacarpals and phalanges are fractures after all and a great deal of unnecessary disability results from inadequate treatment.

One of the common injuries to fingers which causes us some concern in deciding on treatment is amputation of the extreme end of the finger without exposing the bone. To re-amputate and secure a proper wound

closure or to leave the wound open and allow it to heal by granulation is the question. Our experience is: When in doubt, reamputate; this gives a much quicker recovery and the final result is more satisfactory.

Ordinary lacerated wounds of fingers and toes should receive a careful surgical cleansing and primary suture, this being done under local anesthesia if necessary. Often in a simple laceration there is the temptation to let it go with only a dressing, but such treatment always adds materially to the loss of time from work. We believe that a saving of fifteen or twenty minutes in time at the first treatment will often result in a loss of as many days before recovery is complete—penny wise and pound foolish.

Fractures of fingers and toes, metacarpals and metatarsals, deserve much the same consideration as shown to other fractures. Proper reduction, checked by roentgen ray and suitable retention apparatus, is indicated and must be employed if disability is to be avoided. All of this is particularly true in the hand where the function of each part is more individualistic and refined.

Some type of banjo splint is often of great value where reduction can be retained only with continuous traction. Figure I shows two splints of this sort: A is for several fingers and B for one finger. These splints are readily made to suit the individual case by soldering a piece of bent wire to some bits of sheet iron. The splint may be secured to the forearm by adhesive strapping or incorporated in a light plaster cast. Traction is obtained by rubber bands secured to the finger with adhesive strapping, and tied to the end of the splint.

TOPICAL TREATMENT & SURGICAL DIATHERMY FOR
LEUCORRHEA*

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RALEIGH, N. C.

TO the surgeon doing more or less gynecology come many cases which demand mature judgment in determining what procedure to undertake to produce the best result for the patient at the particular time, all circumstances bearing upon the future of the patient being considered.

Foremost among these are those cases of leucorrhea of the non-specific types. Most of them are the result of laceration or erosion following childbirth. Some result from anemia or malnutrition, or pelvic congestion from extragenital causes, or retrodisplacement of the uterus, fibroids, polyps, inflammation or ulcer of vulva, vagina, endometrium, or malignant disease. The etiology suggests the type of treatment.

It is to those forming the largest percentage of cases, namely those due to lacerations or malposition, or both, that I wish to pay particular attention. Many, no doubt, demand ultimate operative procedure for cure; but so many are in women of child-bearing age that repair in such cases would only result in further lacerations in delivery. Obviously it is folly to operate upon such women unless the condition is so bad that waiting would bring on malignancy. On the other hand, to do nothing to many of these cases means inviting malignancy. It is for such cases that I wish to suggest the following treatment Many times a cervix is so edematous, boggy and inflammatory that it simply cannot be repaired. In such cases the treatment often results in a return of the tissues to a much more normal state, lending them to an easy and successful repair.

The treatment is of two kinds: topical methods and surgical diathermy.

1. *Topical treatment* consists in bi-daily hot vaginal douches, using hypertonic salt solution at temperature as hot as bearable, ranging from 108° to 118°F., using about six quarts of this solution, the patient lying in recumbent position, preferably, in a bath tub taking about fifteen to twenty minutes to carry out the procedure. The depleting action of this douche contracts blood vessels and relieves congestion by osmosis and promotes normal pelvic circulation and healing.

At intervals of from five to ten days, depending upon the response to treatment, the outer cervix and canal are cleansed with Dobell's solution to rid them of mucopurulent material and painted with Churchill's tincture of iodine. A wool tampon charged with equal parts of glycerite of tannin, ichthyol and glycerine is applied and left in place for eighteen hours or so and removed by the patient herself. From eight to ten such treatments will cause healing of the average moderately severe case. In those cases where return of symptoms occurs, treatment can be repeated.

2. More recently surgical diathermy has been tried by us with good results in those cases where a radical procedure such as the Sturmdorf operation, or radical amputation, did not seem warranted. This method has been found particularly helpful in stopping leucorrhea in patients who have had supravaginal hysterectomy. In such cases the entire remaining mucosa can be destroyed. By this method of treatment there is practically no scar formation and results are most gratifying. We feel that there is less scar tissue found following this treatment than operation, and it seems preferable certainly in those cases where further pregnancies are anticipated.

All these procedures can be carried out in the office.

* From the Surgical Service, Rex Hospital. Submitted for publication February 27, 1929.

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THE PRESSURE DRESSING[*]

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TO V. P. Blair[1] is due the credit of insisting upon the value of mechanical pressure in the healing of wounds. "In much of the reparative surgery," Blair remarks, "the operator will be tremendously handicapped until he realizes that the satisfactory result is more dependent upon the intelligent application of the older surgical principles than upon an aseptic technic as ordinarily interpreted, though the latter is never to be disregarded." Of these "older surgical principles" he considers properly applied pressure one of the great aids to the natural healing forces and emphasizes its four fundamental advantages:

The elimination of dead spaces.

The control of oozing.

The limitation of venous and lymph stases.

Limitation of the amount of plastic material that pours into the wound.

These observations made from a very extended experience in so-called plastic operations apply with equal force to general surgery. Instances are not wanting to prove the beneficent influence of pressure in every division of surgical practice. Witness the frequent employment of a balanced pressure in surgery of the eye, nose and throat, in orthopedic surgery, in the surgical treatment of chest and abdominal diseases. A firm bandage, a snug splint, a uniform support not only promote the comfort of the patient but also hasten healing, far ahead of loose, sloppy dressings. Quite the reverse is true of pressure applied too tightly and too continuously. Intermittent pressure, as obtained through massage, has its definite uses.

For the past two years I have been interested in the effectiveness of a pressure-dressing applied to incisions in clean cases as well as in those needing drainage. The principle concerned is very old and nothing new or original is claimed for its application. Rather a plea might be made for its advantages, if not for its necessity.

Observation has convinced me that, after closure of the incision, much indifference is frequently evident in the placing of the dressings and their retention. After abdominal operations, for example, adhesive straps are often laid carelessly across the wound, over the dressing, with no thought as to direction or tension. The thought may be entertained that the abdomen will "swell up" to the straps, or that the dressing will maintain itself without intentional arrangement. Too often the retaining straps are so loose as to be uncomfortable, or tight, if at all, in the wrong place. The object of any external retaining material is not merely to hold the dressing in position, but, in addition, to exert firm but comfortable pressure upon the incision and to furnish support for the whole area involved.

To avoid the disadvantage of the routine methods recourse was had to old ideas. It was first found that purposeful pressure cannot be secured over a rounded surface by long straps; the short strap only can produce the correct leverage. Furthermore, to obtain support for the abdomen pressure should be applied not only from side to side, but also both from below, upward and from above downward—a drawing together from all directions instead of a spreading out flatwise.

Consequently, a pressure-dressing was devised particularly for application after abdominal operations. It consists, first, of a short and narrow dressing of gauze, heaped up 4 or 5 times to the height of an inch, placed in longitudinal fashion directly over the incision and held in place by

[1] Blair, V. P. Influence of mechanical pressure on wound healing. *Illinois M. J.*, 46:249, 1924.

three short adhesive straps 1 inch wide (Fig. 1). Secondly, upon this is placed the ordinary large abdominal dressing of gauze

When drainage is necessary it is important that no pressure be placed over the opening, but at one end of the incision, or
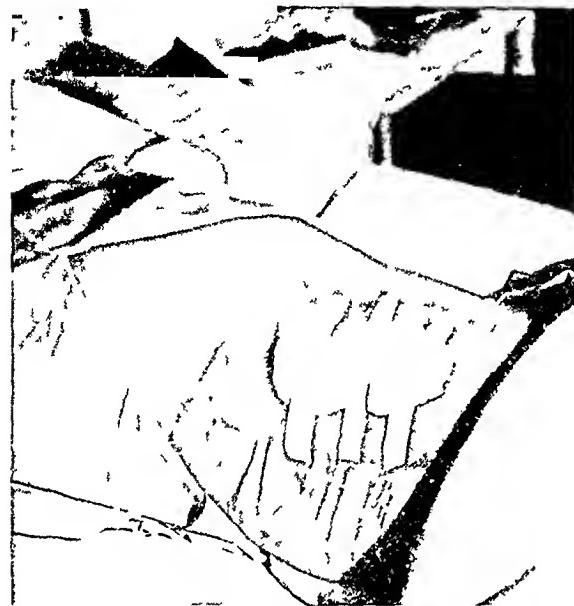
FIG 1 Inside dressing, applied with short straps (This dressing is too wide)

FIG. 2. "Watermelon slice" outer dressing.

and cotton combined, over which is applied longer and wider (3 inch) adhesive straps in a figure-of-eight style producing what I have designated as the "water-melon slice" dressing (Fig. 2). Since the use of this form of dressing as a constant rule, clean wounds have healed properly and surely; not even a collection of serum has appeared in the incisions, as will be the case in many instances where proper pressure has not been employed.

in the middle if a drain is employed at each end.

The pressure method here suggested is believed to be superior to the plan, once largely in vogue, of tying a piece of glass or metal or wood over the incision by means of stay sutures. Such pressure extends only a very short distance on each side of the line of incision, offers no support, and applies an unyielding mass against a fresh wound.

CATHETERIZATION IN THE MALE*

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CATHETERIZATION of the male has so often been followed by serious sequalae that it should be regarded as a surgical procedure and performed as such, so that in the event there should be a complication there can be no criticism or self-reproach. The three basic factors of any catheterization are gentleness, cleanliness and lubrication. A heavy thoughtless hand often makes a simple catheterization difficult.

Rubber catheters should always be the instrument of choice. The smaller the catheter the easier it is for the patient and it is suggested that the maximum efficiency with the least discomfort can be obtained by using sizes 16 to 18 F. Personally I favor the rubber catheter which combines the Coude curve and the olivary tip. These factors eliminate to a great degree the fault of the straight type which has a tendency to hang in the redundant portion of the bulbous urethra.

Silk or gum elastic catheters with Coude tips are the instruments to be used in cases of retention due to obstructive pathology. This type is especially valuable in a urethra which has elastic strictures of medium caliber which ordinarily arrests the passage of the rubber catheter. In prostatic hypertrophy, silk catheters possessing the prostatic curve are more serviceable than those having the Coude tips. In the middle lobe prostatic cases, the Coude tip will oftentimes impinge itself against this lobe, causing trauma with attending hemorrhage. Prostatic cases with retention can ill afford to be traumatized, so always play safe and always use a silk catheter with a prostatic curve, provided a rubber one cannot be passed.

Metal instruments such as metal catheters and tunnel catheters are not for the novice to use. Even in the hands of experts their use is not without danger.

In cases of retention due to impassible strictures in which attempts to pass rubber and gum elastic catheters have failed, one should always remember the whalebone filiform bougie. This is of three types: olivary, angled and twisted. The olivary is used the most but the other types have their followers. In the use of these bougies success is directly proportional to the amount of diligence and patience expended. Should a bougie get by the obstruction and enter the bladder, it should be strapped in place to the shaft of the penis with adhesive tape for twenty-four hours and the patient will get relief in being able to void around it. The further care of this type of case is covered by the dictum: stretch when you can, cut when you must.

The rubber and metallic catheters are prepared by boiling for ten minutes. The silk and whalebone types are best prepared by washing well with soap and water, rinsing well and immersing in a solution of oxycyanide of mercury 1:4000 for ten minutes. Bichloride is not recommended as it is irritating and more toxic.

The patient reclines with the head slightly elevated and the legs separated. The genitalia are thoroughly washed with soap and water, rinsed and covered with gauze saturated with oxycyanide of mercury 1:4000 for five minutes and surrounded with sterile towels. The operator prepares his hands with soap brush and water in the usual fashion for five minutes and after rinsing can use either alcohol or oxycyanide of mercury over them. If sterile gloves are available they should be used. Either side of the patient can be used by the operator. The left hand is used to grasp the penis and this hand

*Submitted for publication February 27, 1929.

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should never change once it has grasped the organ, leaving the right hand free to manipulate the instruments. The penis is grasped back of the glans between the middle and ring fingers. These two fingers can regulate the lateral pressure necessary to maintain the lubricant once it is injected, as well as make the necessary traction to make the penis taut while the catheter is being introduced. The thumb and index fingers of the same hand are free to part the lips of the meatus preliminary to introduction of the catheter. This refinement of holding the penis is a very valuable addition to one's technique and certainly causes less pain to the patient.

With the right hand, lubrication in the form of sterile mineral oil is then injected into the penis with a small, sterile, blunt-nose urethral syringe. The rubber catheter is then inserted after the lips of the meatus have been parted and as the right hand feeds the catheter, the left hand gradually increases the upward tension on the penis until it is taut, which eliminates the redundant portion of the bulbous urethra by putting it on the stretch. Spasm is often met at the approach of the membraneous urethra. Do not try to force the catheter, but keep a uniform gentle pressure and if it is spasm, the external sphincter muscle will soon relax.

If the retention is a sequelae of acute Neisserian infection, always irrigate the anterior urethra with one of the albuminates of silver previous to the preparation of the patient for catheterization, and in addition use a size 10 to 12°F. rubber catheter.

No urethral instrument should be hurriedly introduced; if slowly and gently passed, muscle spasm is minimized and there will be little pain or trauma. If a soft rubber catheter of medium size cannot be passed, a smaller silk one should be tried. If the case is prostatic, use a silk catheter with a prostatic curve. Should the pathology be an impassible stricture, whalebone bougies should be diligently introduced, one after another, and if

successful fastened in situ for twenty-four hours.

Should there be present a small meatus which prevents the introduction of a catheter, a meatotomy should be performed after injecting a few drops of novocaine at the frenum. Care should be observed always to incise in the midline in order to minimize hemorrhage.

Emptying of Cases of Chronic Retention. Never empty a chronically distended bladder at one sitting, because it may cause hemorrhage, shock and anuria, singly or in combination. Decompression has to be slow in order to be safe. The best simple plan is to place a plug in the end of the catheter such as a meat skewer, or oftentimes the end of a pen holder will serve the purpose well, and leave instructions for the attendant to remove two ounces of urine every half hour until the bladder is empty.

Lubrication. This is a basic precept which cannot be passed by saying any lubricant will do. Every drug house puts out a lubricating jelly under a trade name, and recommends it for any type of lubrication. Vaseline is a splendid lubricant, but has a tendency to obliterate the eye of the catheter. The various jellies and vaselines present the same problem, that is to determine if it is evenly distributed throughout the urethra. One does not know, and trauma results if the channel is not properly covered. For this reason it is recommended that some sterile oily liquid be injected into the urethra by a technique hitherto mentioned and one can be more certain of the uniformity of lubrication. It is easier to carry a tube of jelly than a container of oily liquid in your bag, but are you or the patient to be considered?

Instillations. Following catheterization it is always a good plan to leave in the bladder 1 to 2 oz. of a mild antiseptic. The albuminates of silver serve this purpose very well. Septic bladders it is well to lavage with boric acid until the return is clear, previous to instillation.

In postoperative retentions or cases of

bladder atony from any cause, the instillation should be one of an irritating nature. One ounce of silver nitrate in strength of 1:4000 when left in the bladder precipitates silver chloride which is very irritating and stimulates prompt micturition. Glycerine in the same quantity with its hydroscopic qualities is a very irritating drug to the bladder mucous membrane and causes micturition in the most obstinate cases.

Vesical Paracentesis. One cannot close a survey of catheterization completely without a word about vesical paracentesis. When all methods have failed to gain entrance to the bladder per urethra, and the bladder can be outlined suprapubically, one can always relieve a patient temporarily by suprapubic bladder puncture. Textbooks tell what a simple procedure it is to insert a trocar and cannula into the bladder and, after removing the cannula, to thread a small-sized rubber catheter through the trocar, withdraw the trocar and strap the catheter on the abdomen.

This is not an easy procedure and we have found it expedient and most satisfactory to use, instead of the trocar, an 18-gauge spinal-tap needle. In this way the bladder is emptied slowly and the wound is small and there is less chance of extravasation and infection following its use over the trocar. The point of election is in the midline, two fingerbreadths above the pubes, and after shaving the area and preparing the skin with an antiseptic plus the use of either novocaine or ethyl chloride, the needle is inserted in an anterorposterior direction. When the hand feels the loss of resistance the needle is in the bladder. The rate of flow can be regulated by the stylet by placing a small rubber catheter on the end of the needle and allowing the fluid to flow into a container.

INFECTIONS OF THE HAND[*]

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THIS paper is based upon experiences of eight years spent in charge of the Casualty Department of the Birmingham General Hospital, where about fifty thousand patients are treated annually, a large proportion being cases of infections of the hand. During this same period I had the advantage of carrying out very many examinations under the Workmen's Compensation Act, and so have seen many typical examples of what one may call the end result, and I cannot help being impressed by the very large part played by hand infections in damaging the efficiency of industrial workers in our big cities. Indeed so often does a slight cut or prick lead to a permanently crippled hand that it is surprising what little attention is often paid to these seemingly unimportant injuries by the medical profession on the one hand and those responsible for the working of the Factories Act on the other. Even in some of the larger teaching hospitals, the casualty department is under the charge of a senior house surgeon, who, as a student, was never taught to regard his out-patient dressing as one of the most valuable parts of his training, and, in fact, has often been given but scanty instruction upon what is really an extremely intricate matter. The student, time after time, is impressed with the necessity of early treatment in acute appendicitis, but fails to realize the great advantage of prompt and efficient treatment in the very early stages of a simple infected wound of the hand, and yet the loss of earning capacity to the manual worker may be manifoldly greater in the latter than in the former.

ANATOMICAL RELATIONS

There is, probably, no part of the human frame in which the anatomical relations are more intimate than in the hand, and yet this is often quite overlooked in both diagnosis and treatment; in fact surgery of the infected hand is "anatomy plus ·common sense." It is impossible in a short paper to go into much detail, but I will first attempt to emphasize a few anatomical points which have particular bearing upon treatment. The hand and fingers are divided into a number of fascial compartments and synovial spaces so distinct from one another that pus may not, at any rate in the early stages, pass easily from one to the other. There is a right and wrong method of opening these spaces and a clear understanding of them is essential so that we know exactly where to incise. The superficial fascia of the dorsum of the hand is loose and thin, but in the palm it is generally well furnished with fat, forming a pad for the protection of vessels and nerves. It is closely adherent to both palmar fascia and skin. The deep fascia of the arm becomes thickened at the wrist to become the anterior annular ligament, which forms a strong membrane binding down the flexor tendons and the median nerve in the carpal tunnel, which is subdivided into two compartments, one occupied by the flexor carpi radialis tendon and the other by the nerve and flexor tendons to the thumb and fingers. As one would expect, the flexor carpi radialis tendon has a separate synovial sheath, as has also the flexor longus pollicis tendon, although it lies in the same fascial compartment as the remainder of the flexor tendons to the fingers, which are themselves enclosed in a common sheath. The palmar fascia is a thick triangular membrane, with its apex continuous with the anterior annular ligament and ending below by dividing into four slips, each of which ends at the base of the finger by

dividing into two further slips, which become continuous with the lateral sides of the digital sheaths, which are tubular envelopes enclosing the flexor tendons in the fingers. They consist of strong fibrous sheaths attached on either side to the phalanges, and are lined by synovial membrane, which also covers the tendons. The sheaths enclosing the flexor longus pollicis tendon and the flexor tendon to the little finger are usually continuous with the larger sheaths beneath the anterior annular ligament, but those enclosing the flexor tendons of the first, second and third fingers extend into the palm for only a short distance. This anatomy of the synovial sheaths is so elementary that I must ask forgiveness for mentioning it, but it is surprising how often it is forgotten by students.

There are, however, other spaces in the hand which are almost of equal importance, and which have been so carefully worked out by Kanavel. Surgeons accustomed to dealing with large numbers of cases of infected hand have, of course, realized that a collection of pus can remain localized in certain parts of the hand for a considerable period without spreading to other parts, but without realizing exactly why this is the case. And yet how accepted is the fact of spread of suppuration along other fascial spaces of the body, as for instance in the case of a psoas abscess! The structures of the palm are divided into three spaces by the fascia and the key to the situation lies in the origin of the adductor obliquus pollicis and the adductor transversus pollicis. These muscles lie deep in the palm, the former taking its origin from the os magnum and bases of the first and second metacarpal bones and the latter from the shaft of the second metacarpal bone, that is, in both cases deep in the palm beneath the flexor tendons. These muscles are covered by fascia extending deep into the palm, and this forms what is known as the thenar space. The muscles of the hypothenar eminence are also enclosed in an envelope of fascia, and this space takes the name of the hypothenar space. Between these two spaces lies the palmar space, roofed in by the dense palmar fascia, separated by quite dense fascia on the one side from the thenar space and on the other from the hypothenar space. Above, this space is continuous beneath the annular ligament with the fascial spaces containing the flexor tendons in the forearm, while below there are further openings to give exit to the flexor tendons, the lumbrical muscles and the digital vessels and nerves. It was pointed out that the synovial sheaths in the fingers extend into the palm for only a short distance, but it is the proximal ends of these sheaths that are intimately related to the palmar space.

Before we leave the fascial spaces in the hand it is worth remembering that the subcutaneous tissue of the dorsum of the hand, unlike that of the palm, is lax, but beneath this the extensor tendons are enclosed in a layer of fascia, and it is into these tendons that the lumbrical muscles are inserted. The density of the palmar fascia is so commonly given as the explanation of the edema of the dorsum of the hand in the presence of a palmar abscess that the other fact that the lymphatics of the palm run backwards to join the main trunks on the back of the hand is often forgotten. I cannot but think that if these few elementary anatomical facts were more widely appreciated by those called upon to treat the infected hand one would see far less crippled hands and far fewer amputations of stiff fingers, because the ultimate result must depend upon early and accurate diagnosis of the site of the pus, and that all one has to do is to apply the ordinary principles of surgery, respecting anatomical details and foreseeing the probable paths in the spread of the infection. One can recall case after case where ill-conceived and inadequate incisions, often without finding pus, have been made, and in spite of such the sepsis has continued to spread.

GENERAL TREATMENT

I will now pass on to a few remarks regarding the general principles of treatment.

It will be easily appreciated that the first essential in treating infected conditions of the hand is an accurate diagnosis of the situation of the pus. In the majority of cases this is clear when one first sees the case, but when in doubt I do not hesitate to wait for twenty-four or forty-eight hours. It is important to remember that the position of the pus does not necessarily coincide with the maximum degree of swelling, but the point of maximum tenderness is a valuable guide. Edema of the tissues should be carefully distinguished from induration secondary to inflammation. The incision should be a free and adequate one; the majority of primary incisions are, in my experience, far too small and easily become closed. Every pocket should be carefully opened up and any arterial bleeding secured by ligature. Local anesthesia (ethyl chloride), the frequent request of the patient so often acceded to by the practitioner, cannot be too strongly deprecated, except in quite small superficial localized subcuticular infections, for one never knows the extent of the incision with certainty until the pus is found. Novocaine, or any other form of injection anesthesia, must not be used in the presence of infection, there being a real danger of spreading the infection and further devitalizing the already damaged tissues. The wound should be left freely open, and personally I prefer to pack fairly firmly with gauze soaked in flavine, and this should be left in until the next day. The packing will stop all venous bleeding, but even more important, convert the incision into an open cavity and so avoid the tendency for it to close up. Drainage tubes are seldom necessary, and indeed seldom indicated. Occasionally glove drainage combined with packing is useful when through-and-through incisions are indicated, as for instance when the palmar space and lumbrical spaces have to be opened up. It is the practice of certain surgeons, in addition to opening up the collection of pus, to incise freely into the edematous tissue in order, according to them, to relieve the tension. It is a common experience to see the results of such incisions having been made into the dorsum of the hand at the time when no actual pus was present. In a few days suppuration has resulted, which eventually heals, fixing the extensor tendons firmly in scar tissue and leaving the patient's hand crippled permanently for life. Except perhaps in cellulitis of the hand (and even then it is a dubious matter) it is unwise to make incisions other than to give free drainage to pus.

Next in importance to efficient drainage is absolute rest in an optimum position of function. I feel very strongly that all infected hands and fingers should be put on a splint, and kept there until active inflammation has subsided. Rest, and in many cases elevation, add much to the comfort of the patient, but in addition have a definite therapeutic value. He whose lot it has been to attempt to get fingers, which are stiff in the fully extended position, into a more useful one, nearly always with disappointing results, will not hesitate to condemn the prolonged use of the straight splint for hand and fingers. It must also be remembered that the thumb must never be allowed to become contracted in towards the palm. After the first twenty-four hours following operation, the local treatment should consist mainly of frequent hot moist dressings and periodic baths in the more serious cases. I have tried many forms of dressings, but have come to the conclusion that, at any rate during the stage of active inflammation, it is the action of the heat that does most, rather than that of the chemical reagents. I believe that for baths hot sterile water is just as valuable as saline solutions, hypertonic or ordinary, eusol, iodine or anything else. Frequently

I have seen skin eruption which subsequently became infected following the use of iodine baths of quite low strength. In actual practice I use ordinary boracic acid fomentations or gamgee tissue, wrung out in boracic lotion, covered by some form of mackintosh and wool. One should be careful not to allow the skin to become too sodden, discarding the waterproof covering for a dressing or two, or a spirit dressing as a variant is useful. I remember Jordan Lloyd deprecating, nearly twenty years ago, the squeezing of and around infected wounds, and still how often we see it done, often with results quite the reverse of that desired. When once active inflammation is under control the hot dressing should be discontinued, as well as the baths, and ordinary wet dressings (personally I like eusol) commenced. Flavine and potassium permanganate are useful in clearing up very septic wounds, but flavine I think delays healing. When we are quite satisfied that active inflammation has settled down, gradual active movements should be commenced with caution.

I have not been sufficiently impressed by Bier's hyperemic treatment to feel that its use is to be commended. Polyvalent antiscarlatinal serum (and I have recently been told that the antitoxin is better, although I have no experience with it myself) should always be tried in the acute streptococcal infections. It appears to have little effect upon the local lesion, but frequently affects the general condition very beneficially, the temperature often falling in a most dramatic fashion. On occasions I have thought that the intravenous or intramuscular injection of some colloids, such as manganese and iodine, have helped to clear up sepsis, especially when there has been a tendency for it to become chronic. The patient's general condition should not be forgotten. The bowels must be kept freely open and plenty of fluid given during the active stage, and I am particularly attracted by the internal administration of liquor ferri perchloridi.

SPECIAL INFECTIONS

I will now briefly describe a few of the special types of infection of the hand and fingers. The simple cuticular whitlow, resulting from a prick or an infected blister, is easily dealt with by cutting away the whole of the raised epithelium. It must not be forgotten that an abscess of this type, of the finger tip, may quite easily lead to bone necrosis as a result of lymphatic infection. Subcutaneous whitlows of the distal section of the finger are very prone to result in necrosis of the phalanx, quite apart from those actually starting as subperiosteal whitlows. The prick may be so superficial as not to be remembered by the patient. It is interesting to note how nearly always an epiphyseal end of the terminal phalanx remains when "apparently" the whole phalanx is discharged or removed.

Especially important in conservative treatment is the case of the thumb, where length is of great importance. I frequently see a large portion of bone, which has appeared to be the whole of the distal phalanx, discharged, yet the patient has finished up with quite a useful portion of the distal phalanx and a movable interphalangeal joint. Prolonged incapacity is often spared by the early treatment of a paronychia. It will be recalled that the greater part of each lateral border of the nail is overlapped by a fold of skin, and it is beneath this that suppuration commences. It soon travels around the nail and before very long gets under the edge of the nail, separating it from the matrix. The nail root covered by the eponychium easily becomes detached from the nail bed. Surgeons are, with increasing frequency, dealing with these cases by making a longitudinal incision along the edge of the nail, carefully pushing back the overhanging cuticle, cutting away the portion of the nail raised from its bed and leaving the distal portion intact. This may scientifically be a better operation than the older one of removal of the whole nail, but there is a danger of being too conservative and

it is not an uncommon thing, even in expert hands, to have repeated operations for removal of further portions of the nail under which suppuration has spread. Personally, I am not at all sure that the radical removal of the whole nail is not the safest and surest procedure. It is equally important after removal of the whole of a nail to keep the eponychium packed back for a few days. This latter operation has, I think, a more general application, and I doubt if incapacity is any more prolonged.

Probably the most disabling infection of the hand is due to involvement of the tendon sheaths. Sufficient has already·been said to appreciate that although the synovial sheaths of the thumb and little finger are usually alone in their direct communication with the larger bursae under the annular ligament leading into the forearm, the blind proximal ends of the sheaths of the remaining fingers butt into the palmar space and so pus, by bursting into this space, may not only infect other sheaths but pass along the lumbrical spaces and give rise to widespread infection. It is therefore important to diagnose and treat infections of the thecae early, and again it cannot be too strongly emphasized how possible it is to get a whitlow of this type without a penetrating wound to the sheath. The pus which spreads along the sheath as far as it extends is under considerable tension, giving rise to considerable pain and often marked constitutional disturbances. The finger is edematous and tenderness is present along the course of the tendon, while the finger is held rigid in the semiflexed position. Active movements are absent, and any passive attempt gives rise to severe pain. The sheath should be opened up freely along the lateral side of the finger and in front of the digital vessels and nerves.

When possible, however, the sheath just over the joints is preserved, but even this must be sacrificed if one is not certain that it in any way interferes with free drainage. If it has already extended into the palmar space the incision should be carried freely into the palm. It may also have extended along the lumbrical spaces of the dorsum of the hand, when an incision just between the cleft of the fingers of the back of the hand is essential. I have often seen infection in a blister at the base of a finger spreading to the underlying tendon and quickly passing along the lumbrical space to the back of the hand. An incision into the sheath and another into the back, opening up the lumbrical space, rapidly clears up the trouble. It is important to remember that both the thenar and palmar spaces may be secondarily infected from the index finger, while the palmar space may follow suppuration of the sheaths of the second or third, and less frequently the little finger. It is not usual to find the hypothenar space involved except by direct infection through the skin, and then it remains localized.

I have thus attempted in a very brief way to emphasize some of the more important principles in treatment of a subject which does not, I venture to say, receive in the ordinary way the consideration that it deserves. Just as the ordinary cold in the head damages most sensibly the efficiency of thousands of working people every day and often opens up the way to further indisposition, so does the simple injury to the hand, if neglected, often bring serious trouble into industrial life. A small infection, if not efficiently treated, may result in the loss of many working hours, maybe in permanent disability and prolonged and costly litigation, for it is a truism to remark that to the manual worker a perfect hand is as important as a perfect brain.

PARONYCHIA & FELONS[*]

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WITH the popularization of the many and assorted steel instruments for the "better care" of the nails, paronychia or run-around is a frequently encountered lesion of the distal phalanx of the fingers. Improper removal of the lateral outgrowth of the thin edge of the nail, the so-called hangnail, often causes a break in the continuity of the skin, thus permitting or inviting invasion of microorganisms.

The common types of invading organisms in their order of frequency are: the Staphlococci aureus and albus, the streptococcus, and mixed infections from the human mouth. Rarer infections such as pneumococcus, diphtheria bacillus, gonococcus, blastomyces[1] and tubercle bacillus[2] have been reported, the last two mentioned being of great chronicity.

Following the inoculation there usually appears a red area at the distal part of the nail fold followed by swelling and tenderness. This may subside with or without suppuration, remain local or extend backward along the under surface of the nail edge. In the former instance, when the infection remains local, the worst that will happen will be a small abscess formation which has for its uppermost covering a firm, insensitive, thick skin. The treatment is the simple paring away of this thick skin with evacuation of the pus. A cure follows very quickly without any residual disturbing scar.

In case the swelling increases and the redness extends along the nail fold, a true run-around is forming. Untreated the infection spreads along the subungual space at the free border of the nail until it reaches the root of the nail situated over the matrix. The attachment of the nail at this point is less firm than the anterior part, so the entire nail root is lifted from its bed,

the pus finally breaking through to the exterior from beneath the cuticle. The anterior closed space is almost never involved because of the unlikelihood of the organism invading the very dense barrier of connective tissue situated in the floor of the nail sulcus.

The surgical treatment is early intervention, preferably under gas anesthesia, but in case a general anesthetic is contraindicated the digital nerves can be blocked at the proximal part of the finger. Two incisions are made (Fig. 1) beginning in the nail groove and carried backward so that the cuticle is not injured. The flap thus formed is dissected upward, exposing the nail root (Fig. 2). One blade of a sharp-pointed pair of scissors is carefully inserted beneath the detached nail root and the base of the nail trimmed away. A small gauze pack is placed loosely into the operated area and the flap brought back into position. (Fig. 3.) About twelve to twenty-four hours after the removal of the base of the nail, the entire hand should be soaked in a warm boric acid solution for two to three hours, every six hours. The dressing should be changed daily but the gauze pack should not be removed until the end of forty-eight to sixty hours. It is not necessary in the average case to re-insert a pack but the wound should be cleansed daily with hydrogen peroxide and washed with saline or boric acid. After four or five days the soaking can be discontinued and dry dressings applied with a small amount of sterile vaseline to prevent the dressing sticking to the wound.

There are several points to bear in mind with reference to the matrix, because upon the care and thought given to this structure depends the growth of a new nail and a satisfactory end-result. First, delayed treatment will often injure the matrix to

such an extent that the new nail will be thick, rough and unsightly. Second, when the flap is turned down there should

lead directly into the outer surface of the bone, separating the space into compartments containing fat. The periosteum,
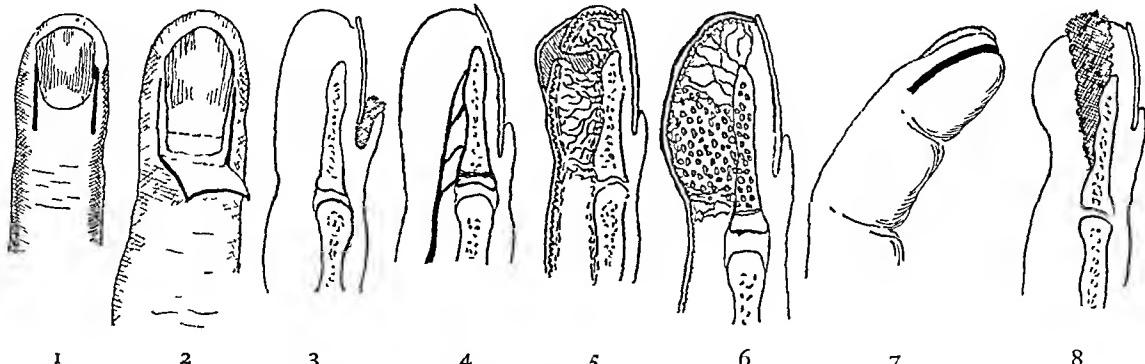
FIG. 1. Paronychia. Site of incisions to avoid injury to cuticle and matrix.
FIG. 2. Paronychia. Exposure of nail root. Area proximal to dotted line to be removed.
FIG. 3. Paronychia. Gauze pack in place.
FIG. 4. Blood supply to epiphysis and diaphysis. Note epiphyseal branch does not traverse anterior closed space.
FIG. 5. Typical collar-button abscess.
FIG. 6. Mode of invasion and involvement of phalanx.
FIG. 7. So-called fish-mouth incision (about two-thirds shown).
FIG. 8. Method of establishing bone drainage without dealing directly with bone. Gauze pack in place.

be a good exposure of the nail root so that when the base is removed for proper drainage no damage is done to the matrix, thereby avoiding the possibility of a split nail. Third, the cavity should not be packed too firmly with gauze for fear of disturbing the circulation in the matrix.

We do not advocate that the radical procedure be carried out in all instances as the surgeon must judge for himself how much involvement is present, but the entire roof of the abscess cavity must be removed or secondary operation will be necessary.

FELONS

Felon, bone felon, painful whitlow or the more recent and descriptive term, anterior closed space infection, is an infection of the fat pad of the distal palmar surface of the finger, frequently accompanied by osteomyelitis limited to the bone of this phalanx.

In order to understand why an infection of the distal anterior closed space is usually limited to this space and so frequently associated with osteomyelitis of the distal phalanx, one must have a knowledge of the anatomy of the part. From just beneath the thick skin, dense connective tissue septa

particularly in the adult, is firmly attached to the irregular surface of bone by periosteal prolongations. The branches of the digital arteries, which are small and widely scattered, traverse these compartments, many entering the bone to anastomose with the circulation of this structure. The blood supply of the epiphysis is a small branch from the digital artery which does not traverse the anterior closed space (Fig. 4).

When the continuity of the skin is broken by a sharp penetrating object, a small cut, a bruise or a mild crushing injury, an avenue for entrance of microorganisms is opened. The common invading bacteria being, as in paronychia, Staphlococci aureus and albus, streptococcus and the mixed infection from the human mouth.

Following the accidental inoculation (about twelve to thirty-six hours) the patient feels as if there were a "splinter in the finger." This discomfort increases in severity, rapidly becoming throbbing in character. In case the infection is rather superficial and the organism is not too virulent, continuous hot soaking, by bringing more blood to the part, may arrest the condition without suppuration. In the

event one of the fatty, relatively avascular compartments is involved, the process may remain local to one or two compartments, thereby resulting in a small subcutaneous abscess which may communicate with a visible subepithelial pustule, the collar-button abscess (Fig. 5). Most often, however, when once the infection has been introduced the cellulitis, hemmed in by the tough skin and the dense connective tissue septa, spreads inward toward the bone (Fig. 6). The swelling increases, the finger becoming more tense until a point is reached where the pressure without the arteries is the same or greater than within. Circulation is impeded, thrombosis follows and necrosis is the end result. The diaphysis of the bone thus becomes involved most likely by direct extension through the arterial channels.

Following one or two sleepless nights and the application of varied concoctions advocated by the family, friends and the corner druggist, the patient comes to the physician, who too often is conservative, thereby allowing sufficient interval for invasion, if not the destruction, of bone. When this clinical picture presents itself, there is but one course, wide incision (Fig. 7) without rongeuring or curetting the bone. Even at a later stage of a similar untreated process, when the roentgenogram shows frank bone destruction, the bone should not be disturbed unless a loose sequestrum is present, in which case the sequestrum is removed with as little disturbance to the remaining bone as possible. The reason for this, especially in the adult, is that by rongeuring away the diseased bone, the periosteum, which cannot be separated, will also be destroyed.

Following incision, which is preferably done under gas anesthesia, the wound is packed with gauze (Fig. 8) and after about twelve hours continuous warm boric acid wet dressings applied to the entire hand. The gauze pack is left in place for two days at which time it will come away without

very much pain. The outer dressings, however, should be changed daily. After this forty-eight hour period of moist heat, it is well to alternate every three or four hours, warm wet dressings and some type of dry heat, to avoid maceration of the skin. The wound should be kept open with a light gauze pack until granulations appear at the base, the ordinary surgical care being used to insure proper epithelization. In case there is sequestration, the dead segment of bone will find its way through the open wound.

When end result is to be expected from a properly treated felon with bone involvement? In a child, sequestration of the diaphysis is early and complete; therefore when the usual incision is made, this segment of bone is frequently found lying free in a pool of pus. A perfectly formed distal phalanx will regenerate within a period of two to four months.

In an adult, sequestration is seldom so complete, probably due to the fact that the periosteum is more adherent, and the blood supply is not suddenly and completely interrupted when the infection invades the medullary cavity. However, by early drainage even though the roentgen ray shows extensive bone involvement, resolution takes place with but little if any discharge of bone and a fairly sized and useful phalanx reforms.

In some instances there is a prolonged discharge which often results in an adherent and tender scar or a broad and troublesome cleft. This can be excised with accurate approximation of the skin edges in hopes of obtaining a smooth surface.

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INFECTIONS OF THE BREAST*

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FORMERLY acute infections of the breast were very prevalent after childbirth, and frequently in a severe form. Fortunately, specializing in obstetrics, a better control of midwives, and more attention paid to cleanliness and common sense have all combined to make such occurrences comparatively rare. And yet it must be borne in mind that carelessness and failure to look after details may at any time lead to serious infections and even deep suppurations.

As in all surgical affections, low resistance is a predisposing cause, and should be avoided by appropriate handling of the patient during pregnancy and after the birth of the baby.

The infection practically always enters through the nipple by way of the milk duct or lymphatics, and is usually due to staphylococci, though other and more dangerous germs may be present. Such infection is carried on the hands of patient or attendant, from unclean things and from diseased conditions of mother or baby.

If the baby has any ulcers of the mouth, a nipple shield must be used.

During the last few weeks of pregnancy, in addition to strict attention to the general health, the breasts must be bathed frequently and supported if need be, and the nipples made soft by the daily application of sterile lanolin. If the nipples are depressed they must be gently pulled out. They should also be kept covered with soft clean gauze or cotton.

After confinement, until the milk begins to come, the baby should be put to the breasts infrequently, the baby's mouth wiped out before and after each nursing with sterile water, and the nipples with the same, the breasts being kept covered with sterile gauze. Rubbing or pumping of the breasts, when necessary, must be done with gentleness and strict attention to cleanliness. This sterile cleansing of the nipples and baby's mouth should be continued indefinitely.

Frequently it is difficult to get the milk to start and the breasts become distended, hard and painful (so-called "caked breasts"). This condition is not an infection and can usually be relieved by careful pumping and moist applications. A most effective application is made with liquor Burowii[1] (acetate of aluminum), one part to six parts water, used with moist gauze and protective, such as oiled muslin or waxed paper, and changed frequently.

If the nipples become cracked or ulcerated, nitrate of silver, 10 per cent solution, should be applied and the breasts used less frequently.

At no time should the baby be allowed to hold the nipple in the mouth after the completion of nursing.

Infection of the breast shows itself by swelling, pain, fever and at times a chill. There is also acute tenderness, usually localized. The peculiar anatomy of the breast, and its condition during lactation, makes it easy for infection to spread rapidly.

The same wet dressing, frequently changed, with a tight binder, together with gentle pumpings of the breast and the application of an ice bag, will frequently relieve the condition, or aid in the localizing of the pus.

If an abscess is inevitable, it will show itself by localized tenderness, and should

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[1] Formula for liquor Burowii:

Acetate of lead	7 gm.
Sulphate of alum	20 gm.
Distilled water	220 gm.

This is allowed to stand for two hours. Chemical reaction takes place, resulting in a solution of acetate of aluminum, sulphate of lead being precipitated. Thorough filtering is required to get rid of the latter.

be opened promptly even before fluctuation is distinct. Small abscesses usually form superficially, frequently under the areolar around the nipple from dilated milk ducts and should be freely incised, by radiating incision, using local anesthesia or nitrous oxide oxygen if available. The cavities should be wiped out with mercurochrome and freely drained with rubber dam.

All incisions into the breast gland should be in a direction radiating from the nipple so as to avoid as far as possible injuring the milk ducts.

A wet dressing of 1 per cent carbolic gauze with protective, and a large padding of cell cotton over the whole, followed by a very tight binder or bandage, will usually prevent the spread of the infection. A daily antiseptic dressing of the wound, with pumping of the breast, as often as necessary, will bring about prompt healing. It is, of course, best not to put the baby to an infected breast.

Deep abscesses of the breast require more vigorous handling. Fortunately, they usually occur in the lower part of the gland. To prevent scars they can often be reached by a curved incision at the lower edge of the breast, the finger inserted and the cavities freely opened by finger dissection. Rubber dam and cigarette drains will provide free drainage and prevent pain at dressings. At times, gauze has to be used to stop bleeding. When this is removed a few whiffs of gas is advisable. Wet dressings with pressure are used here also.

An abscess may form at any part of the breast and may have to be opened at the point of tenderness. Regardless of the after scar, it is then necessary to make a radiating incision with finger dissection, drainage and pressure wet dressings as already described.

Occasionally the surgeon meets with one of the old time cases in which a large part or the whole of the breast is abscessed, and it becomes necessary to make multiple radiating incisions. Such cases were of frequent occurrence years ago, but are rarely seen today. The old treatment, however, still holds good, and brings prompt relief and rapid healing.

Deep radiating incisions are made, the breast thoroughly explored with the finger, and the cavities, after cleansing, are packed full of wet 1 per cent carbolic gauze, with a few layers of wet gauze covering this and then a large soft sea sponge which has been wet in the solution and squeezed out. The whole is covered over with protective and a *tight* bandage applied. As soon as the patient can be propped up a little, the same solution is poured in at the upper edge so as to saturate the sponge and cause increased pressure.

The next day the dressing is changed, the packing being removed, the wounds washed out, and fresh wet gauze applied over the breast, without packing, with a reapplication of the sponge and bandage. At the next dressing a remarkable change is shown, the cavities being practically obliterated and the wound appearing clean.

It usually takes only two or three more such dressings, after which the wounds in the breast are treated as ordinary wounds, the skin being rapidly brought together. It is necessary, however, to keep up sufficient pressure to hold back the formation of milk.

A "wet pressure dressing" is helpful in all abscesses of the breast. Rubber tubes are not advisable. Rubber dam is much more useful.

The breast may be the seat of other forms of infection such as from caries of a rib, traumatic abscess, tuberculosis, or gumma.

NON-OPERATIVE PROCEDURES
IN UROLOGY*

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THE remarkable stride which has been made in the development of cystoscopic technique within the last two decades, the better understanding of underlying pathology made possible by the introduction of urography, have tended to conservatism in the management of urological conditions to a degree never known before. Caulk in his presidential address before the American Urological Association laid emphasis on the fact that "in spite of surgical preparedness and surgical efficiency, the striking tendency of urology today is conservatism. Science has reduced urological surgery in the last quarter of a century to a striking degree in spite of the fact that it has given facilities for its advancement . . . Many of the operations have been either restricted or erased from our surgical calendar."

However true the above may be, a word of warning is in order against over-indulgence in conservative manipulations in various obstructed, infected or neoplastic lesions of the urinary tract. A line must be drawn sharply between what constitutes an operative lesion or a condition where cystoscopie measures have a reasonable chance to succeed. This entails a careful study of the case and a correct diagnosis. Too much temporizing with true surgical conditions is the one great danger so commonly seen and which must be avoided.

I shall endeavor briefly to enumerate the various conditions in the urinary tract which may be corrected by the employment of minor surgical procedures in as much as they entail cystoscopic manipulation, touching upon indications and, as much as the space will permit, on technique.

1. *Urethral stones* frequently become lodged either in the anterior or posterior urethra. The presence of an old stricture or a small meatus or a naturally narrow urethra is the factor which prevents the passage of a stone. These stones are usually freely movable and may be made to pass by slitting the urethral meatus and dilatating the urethra with sounds below the stone, supplemented by instillation of sterile olive oil. It is well to compress the urethra by a tourniquet so as to prevent the stone slipping back and after the urethra has been sufficiently dilated the stone may be expressed in a way very similar to the expression of a kernel out of a cherry.

2. *Prostatic stones* ulcerating into the urethra produce very annoying symptoms. These may occasionally be easily liberated by the Collings cutting current applied to the mucosa around the stone so as to enlarge the opening.

3. *Obstructive lesions at the neck of the bladder*, such as median bar or contracture of the vesical neck, may be relieved by burrowing a channel through which urine may find an easy exit either by cutting out the obstructive tissue with Young's punch or an employment of Caulk's electric cautery or Collings' technique. The recognition of proper indication is of paramount importance. To subject a case of true prostatic hypertrophy to such palliative procedure as mentioned would be hazardous and because a correct diagnosis may at times be difficult, one must especially be guarded against possible pitfalls.

I have been particularly impressed by the work done by Collings in the removal of the obstructive bar by means of a cutting current under direct vision through the McCarthy panoblique cystoscope in

that it eliminates to a great extent the element of guesswork incident to other methods and the danger of hemorrhage. For a description of the operation, which is best performed under spinal anesthesia, I would refer the reader to his publication on the subject.

4. *Vesical Calculi.* Ureteral stones lodged in the bladder or very small calculi may be removed by forceps introduced through an operating cystoscope. The same is applied to the removal of small foreign bodies such as broken off pieces of catheters, hair pins, etc. The technique is very simple and does not require spinal or general anesthesia. For larger stones, measuring from 10 to 15 mm. in length, I know of no better instrument than Young's rongeur (a forceps built along the lines of a cystoscope). Although the instrument is not built for crushing hard calculi, occasionally much larger stones (20 to 30 mm.) of softer consistency may be crushed and removed piecemeal by the rongeur.

Primary vesical calculi not associated with obstructive lesion at the neck of the bladder are rare both in the male and in the female. Any attempt to remove secondary calculi, even if such are of small size, by cystoscopic means should be regarded as a useless procedure unless the primary obstructive lesion at the neck of the bladder, such as an adenomatous hypertrophy, is corrected. Occasionally one sees large vesical calculi with no obstructive lesion at the neck of the bladder or in the urethra and in such cases the more powerful lithotrites are indicated. These crushing instruments, devised by Lowsley, McCarthy, Joseph and Ravich, are built along the lines of the old Bigelow lithotrite but are provided with lenses and a lamp so that crushing is done under vision. I am particularly acquainted with the Ravich lithotrite and on one occasion I was able to crush with his instrument a stone measuring 29 by 35 mm. (Fig. 1). The crushing should be done under spinal anesthesia and the fragments are removed

by a suction pump. Frequently the larger fragments may necessitate the introduction of the Young's rongeur for their removal.
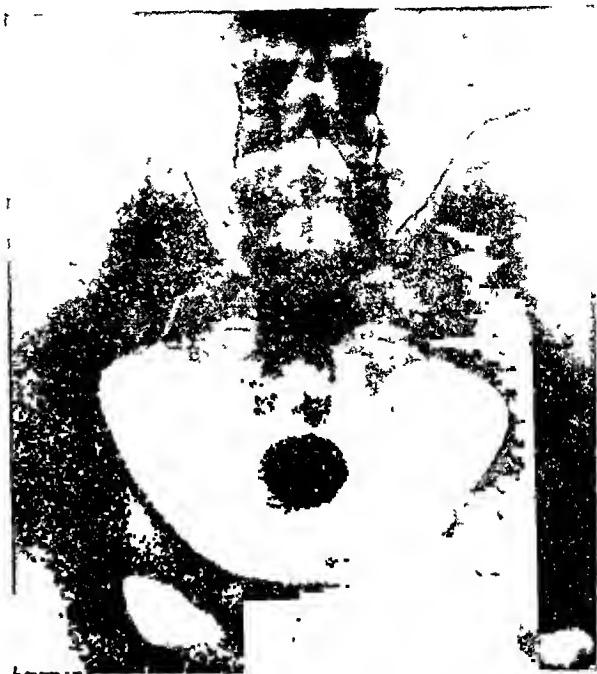
FIG. 1. Large vesical calculus measuring 29 × 35 mm. crushed under direct vision by Ravich lithotrite.

5. *Vesical Neoplasms.* The epochal introduction of the high frequency current (bipolar or unipolar) by Beer in the treatment of benign vesical growths constitutes one of the greatest advances that has placed urology at its present high degree of efficiency. The proper recognition of the type of growth is essential either by its cystoscopic appearance or by removal of a piece of the growth (through the cystoscope) for a microscopical examination. It cannot be too strongly emphasized that the use of fulgurating current applied to malignant lesions is of no avail. As the proper recognition of this type of tumor may at times be difficult this method of therapy should be abandoned once it becomes evident after a few trials that it has not resulted either in diminution or total disappearance of the growth.

The important point to bear in mind in the treatment of vesical tumors by means of fulguration is that the current

should be applied as near the base of the growth as is mechanically possible.

In malignant as well as benign growths of the linear grooves (channelization by urine) on calculi, which permit a more or less free drainage. These grooves were
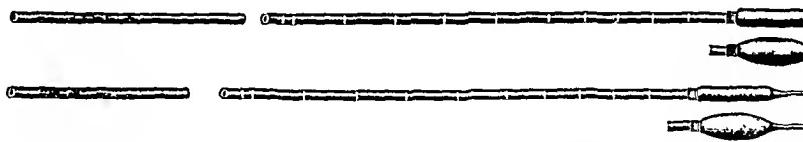
Fig. 2. Author's rubber bags used in dilatation of ureter, before and after inflation. Note that lower rubber bag has filiform tip which facilitates passage into ureter.

of the bladder complete disappearance of the tumor may be occasionally noted with the use of radium therapy. The tumor may be irradiated either with the whole element introduced into the bladder by means of a special forceps or with implantation of radium emanation seeds. Here again it is essential to implant the seeds as near the base as possible. Because of the unfavorable position of the tumor, it is often a matter of mechanical impossibility to secure the proper introduction of the seeds through the cystoscopic route and the nearer the growth is to the neck of the bladder the greater is the difficulty, because even with the best deflection of the radium-containing implanter, it is often impossible to guide it into the base of the growth. In such cases an open operation should unhesitatingly be resorted to even if nothing else is contemplated than the introduction of seeds. Recently the author had implanted radium emanation seeds into the tumor at the neck of the bladder through the anterior wall of the bladder through which the growth was distinctly palpable.

6. *Ureteral Stones.* It is in this field of urology that the application of mechanical devices coupled with a better understanding of the regulating forces and compensating mechanism incident to calculous obstruction has resulted in possibly the greatest reduction of major surgical operations. The presence of a stone in the ureter, even for many weeks and months, may inflict either no damage at all to the kidney, or too slight a damage to be of any serious consequence because

observed by the author in 34 per cent in his series of 424 cases. The so-called mulberry calculi, or those studded with spiculi, owe their configuration to the urine burrowing its way to the bladder all over the surface of the stone and are not included in estimating the percentage in the figures just mentioned. This protective mechanism constitutes the basis for conservatism in the management of ureteral stones as the latter may be allowed to remain in the ureter with reasonable safety for a considerable period of time, before considering a major surgical interference, with the hope that they may be brought down by cystoscopic means.

Here again a word of warning is in place against too much temporizing with cases which clearly present a major surgical problem, such as acute fulminating renal infections resulting from obstruction below, where calculi are too large, in cases of bilateral impaction or reflex calculous anuria with impending uremia in which cystoscopic interference failed to produce immediate re-establishment of renal drainage and finally, when repeated cystoscopic attempts to bring down the stone proved to be futile.

The aims sought by cystoscopy are: (1) to establish renal drainage by breaking up the impaction. This is best accomplished by one or more catheters left indwelling, after one succeeds in passing them by the obstructing stone. (2) To combat renal infection. (3) To bring immediate relief to the patient seen during an acute attack of renal colic by draining off by means of a catheter the urine trapped above the

obstructing stone. (4) To facilitate the downward passage of the stone. Even if the last-named object is not forthcoming, a
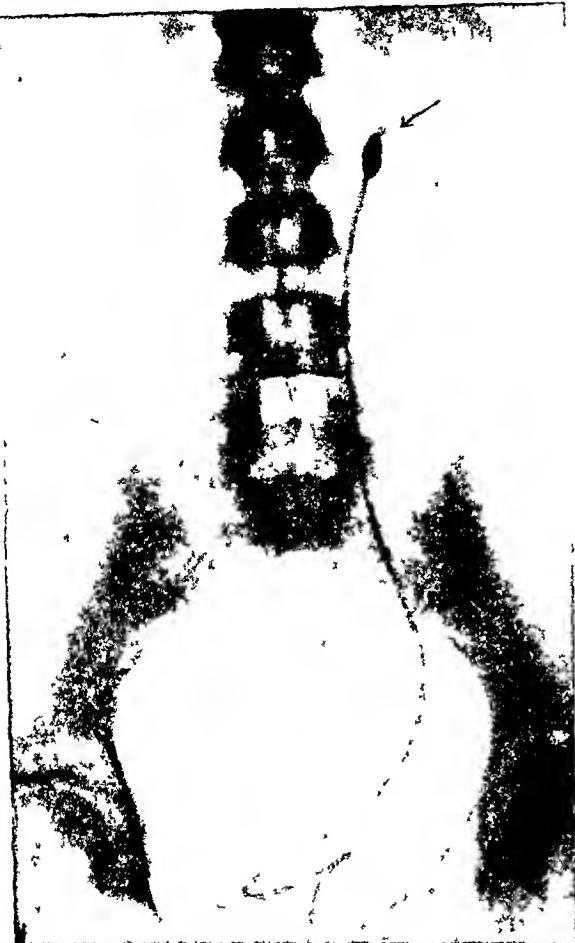
Fig. 3. Stone in upper portion of left ureter with inflated rubber bag just below it. Arrow indicates position of stone.

great deal is accomplished in the way of saving a kidney by catheter drainage as a temporary procedure before surgical interference for the removal of the stone is resorted to.

There are two groups of cases which one is called upon to treat: (a) acute cases; (b) chronic cases.

a. Acute Cases. In this group calculi are as a rule small and their expulsion may be facilitated by the use of catheters (passed by the stone) which should be left indwelling anywhere from two hours to several days. Occasionally a small stone may block the intramural portion of the ureter, producing such an enormous edema

of the mound as to render intraureteral manipulation impossible. In such instances the light application of a high frequency
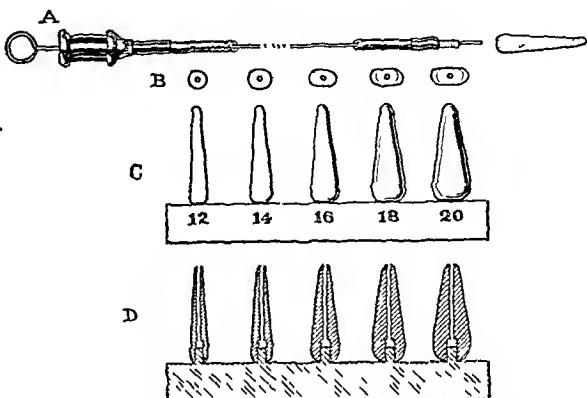
Fig. 4. a. Author's tunnelled bougies and catheter.
    b. Cross section of tunnelled bougie at proximal end.
    c. Various sizes of tunneled bougie screwed into bar.
    d. Vertical section of tunneled bougie.

spark to the edematous mass will result in the abatement of the edema and the release of the stone.

b. Chronic Cases. Here we have a history of repeated attacks of renal colic extending over a considerable period of time. The stone is as a rule large, is frequently grooved and is found in the majority of cases in the lower end of the ureter. The attacks of pain I believe are due to the clogging of the groove by urinary sediment, producing sudden retention. The expulsion of the stone in such cases may be facilitated by: (1) The breaking-up of the impaction by indwelling catheters or filiform bougies as in acute cases; (2) dilatation of the ureter below the stone, to a degree at least equal to the width of the stone.

Before ureteral dilatation is attempted it may be necessary to enlarge a congenitally small orifice by slitting it with scissors. The employment of a fulgurating spark for this purpose I believe is harmful, as the resulting scarification may produce complete ureteral block.

Dilatation of the ureter below the stone may be produced by rubber bags (Fig. 2) inflated with water, a method introduced

by the author three years ago. The extent of dilatation may be well ascertained by roentgenogram when an opaque solution, such as sodium iodide, is used for inflation (Fig. 3). When stones are situated just above the intramural portion of the ureter the use of the Bransford Lewis dilator, the Buerger olive bougies or the author's tunneled bougies (Fig. 4), which may be employed in conjunction with the instillation of hot olive oil, should be resorted to. It is difficult to dilate the intramural portion of the ureter with rubber bags because most of the inflation will take place within the bladder (that is, in the line of least resistance).

In some instances large calculi situated in the intramural portion of the ureter may be made to pass into the bladder by a linear incision with a fulgurating spark directed over the stone. The orifice should be carefully watched subsequently and if need be it should be kept dilated.

I feel that any device calculated to bring down the stone by force (unless the stone is seen to protrude from the orifice) is pregnant with dangerous possibilities and should not be employed.

The degree of success expected from cystoscopic manipulation, aside from the size of the stone or other factors already mentioned, depends largely upon the location of the calculus. In my series, 95 per cent of stones lodged in the lower end of the ureter were amenable to removal by cystoscopic manipulation; while the same was true only in 46 per cent of cases when in the upper portion.

7. *Ureteral Stricture.* In my own experience strictures of inflammatory origin with focal infection as described by Hunner were rarely encountered. However, congenital narrowing of the ureteral orifice and of the intramural portion of the ureter is of frequent occurrence, analogous to the stenosis of the meatus so commonly seen in the male urethra. This anatomical defect plays an important rôle in the production of renal calculi, hydroureteronephrosis and reno-ureteral infections. Correction of such defect by slitting the stenosed orifice with scissors and dilatation of the lower end of the ureter may be well accomplished through the cystoscopic route.

8. *Renal Infections.* Here again it is important to arrive at the correct diagnosis by cystoscopic investigation as well as by clinical study as to what constitutes a "surgical kidney" and simple pelvic infection. The latter, so commonly seen in children and in pregnancy, may be readily combated by pelvic lavage with antiseptic solutions and drainage, after all other methods, when given a fair trial, have failed. The use of a warm solution of silver nitrate (1:400) gives probably the best result. The spectacular drop of temperature and the disappearance of pus and bacteria in the urine so commonly seen even after a single lavage, in pelvic infections which stubbornly resisted all other methods of treatment, is, indeed, very gratifying.

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EPITHELIOMA OF EXTREMITIES[*]

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THIS study was undertaken at the request of the late Dr. C. A. McWilliams, a few months before he died. On that service we had had several patients with this condition in rapid succession. It so happened that in none of them was there any involvement of the axillary nodes, although they were removed radically in all cases. In some the epitrochlear node was also excised, apparently unnecessarily. In order to find out whether or not fuller statistics would show similar results I went through our records here. As our histories were in very poor condition at that time I subsequently included all of this type of case which had occurred at St. Luke's Hospital since 1897, and a private case of Dr. Schley in which Dr. Wood had examined the specimen. At this time I wish to express my thanks to Dr. Wood, through whose courtesy I was given access to their charts. This report is based on 37 cases.

The question to be determined was whether the condition, which histologically was the malignant type of epithelioma, called variously spinous, prickle or squamous celled, might not clinically behave like the tumor that had been produced in rabbit's ears by Drs. Wood, Rohdenberg and Bullock,[1] and others by painting or injecting them with Scharlach R, pine tar or other irritants. These tumors under the microscope are indistinguishable from the very malignant growths found on the human lip, tongue, vulvar and rectal mucosa. Clinically, however, they behave very differently, growing very slowly, never metastasizing, and disappearing completely and permanently when treated with one erythema dose of roentgen ray, an amount entirely insufficient to have any curative effect on human cancers.

Rohdenberg and Bullock[2] have also produced carcinoma by inserting a ball of bristles in the rat's stomach. However after these balls are removed, and biopsy shows a typical carcinoma, the lesion heals spontaneously in two or three months and autopsy subsequently shows no trace of malignant disease.

The literature on the subject, especially in English, is rather meager. Heidingsfeld[3] in 1900 reported 1 case without mentioning the microscopic findings or the treatment. Muehleck[4] in the *Transactions of the Pathological Society of Philadelphia* gives a short summary of previous articles without adding any particulars. Douglass and Culver[5] of San Francisco in 1915 reported 6 cases, all treated with roentgen ray without pathological examination. Fox[6] in 1915 reports 1 case caused by a horse bite, proved by biopsy, with enlarged axillary nodes, and a roentgen-ray report of pulmonary metastases, but no operation or autopsy. He adds a fairly thorough summary of the literature. McFarland,[7] in January, 1928, cited 1 case treated by roentgen ray and bipolar diathermy with later proved axillary involvement.

The article by R. Volkmann[8] in 1889 was the first thorough study of the subject and in it is stressed the fact that these tumors are invariably of the squamous cell type, but that they are relatively benign clinically, in spite of their histological malignancy. Weilepp[9] says they have the best prognosis of any skin cancer if those originating on warts and moles are excluded. Labiche[10] says there is little tendency for the nodes to be involved. Bouche[11] agrees with this dictum and adds that the untreated cases have an average duration of life of from eight to nine years

as compared with that of one to two years in histologically similar lip tumors, or with internal cancers.

The condition is undoubtedly rare. Heimann[12] lists 207 cases in 20,544 cases of carcinoma; Gurlt[13] 155 in 3,422; Winiwarter[14] from Billroth's clinic, 9 in 548; v. Bergman 17 in 254; Bulkley and Janeway[15] 2 in 417. At the Skin and Cancer Hospital I found 26 cases out of over 35,000 patients admitted to the hospital. This is undoubtedly too low an incidence as I took no account of any case where there was not a pathological examination. Many patients came in, were diagnosed clinically and then went home refusing operation. In others, due to the very inadequate history system at that time, the pathological record was misplaced. At St. Luke's Hospital in thirty-one years there have been only 9 cases admitted to the wards and subjected to operation, and 6 operated on in the dispensary. In all of these the pathological report was on file in the laboratory but the histories of 5 from the Out Patient Department could not be found, so I have not included them among the cases here reported.

The predisposing causes as stated by Von Brunn[16] fall into three groups, and he states that in his series of 321 cases they were divided as follows:

Group 1. 227 cases; on a basis of chronic inflammatory tissue such as ulcers, scars, fistulae, lupus, osteomyelitis etc.

Group 2. 46 cases; on warts or moles, congenital or late.

Group 3. 48 cases; on apparently normal skin.

Occurrence after a single trauma is rare; Würz[17] states that it occurred in 4.6 per cent of his 174 cases; and prompt appearance thereafter is even rarer. In this series there were 3 cases that gave a history of only one injury without subsequent infection; the earliest of these reported that the lesion appeared eight months later, the others at two and three years. Eleven gave a history of some previous injury. Von Brunn's[16] Group 2 I have eliminated almost completely as they are an entirely different tumor, melano-epitheliomata, and undoubtedly of the most virulent malignancy. I have therefore not considered as properly belonging to the type of tumor under discussion any case in which the pathologist reported the presence of pigmentation. (I really should not make a statement quite so strong as this. In discussing this paper with Dr. Wood he advised me to include no cases in which the original insult to the tissues had been caused by roentgen rays or radium as they "grow like wild fire." It so happened that there was only 1 case in the series that gave such a history. She was treated with roentgen rays for keratosis of the soles in 1901. In 1906 she went to St. Luke's Hospital for epithelioma of the soles of both feet. She was operated upon then on the right foot and six months later on the left. She then disappeared until 1920 when she returned with recurrences on both feet, was reoperated upon, had further return of the condition in 1923, was again operated upon, and has not been heard from since in spite of much effort of the follow-up department.)

These epitheliomata are reported as more common on the leg than on the arm. Von Brunn[16] found 95 out of 368 on the hand. Muehleck[4] states that the proportion is 3:2. Over 50 per cent of those on the lower extremity are on the lower leg, probably because so many of them arise on a varicose ulcer as a base. Over 60 per cent of those on the upper extremity occur on the back of the hand, according to him. Occurrence on the palm is very rare, Von Brunn[16] finding only 2 in 95, Franz[18] only 3 in 74.

In this series only 5 occurred on the lower extremity, all of them on the foot. One each was found on the elbow, the forearm and the wrist, 2 on the fingers, and 27 on the hand. In 14 of these it was specified that the back was involved, in the other 13 the part was not mentioned.

Muehleck[3] says that two-thirds of the cases occur in men, and that over 50 per

cent of them develop between forty and sixty years of age. My figures show only 9 women, an incidence of just under 25 per cent; and a considerably higher age distribution, i.e., 22 cases, approximately 60 per cent, between sixty and eighty years, and an additional 20 per cent between fifty and sixty years. In other words, 80 per cent of the patients have passed the age of fifty years. The youngest patient was thirty-one and the oldest was eighty-two.

Nationality was not noted in any of the series previously reported. I found that 17, or almost 45 per cent, were born in the United States. Of the remainder 50 per cent were Irish, 16 per cent Italian. and one patient from each of five other countries.

The occupation seemed to make very little difference, the most common one being "housewife" of which there were 8, including all the women but one, in whose case no occupation was given. Activity was definitely of an outdoor type in 9, indoor in 8 women and 6 men, doubtful in 5 and not given in 9. They included 1 bootblack, 1 laborer, 2 boatmen, 2 masons, 2 farmers and 1 orthopedic surgeon.

The duration of the trouble before coming to operation varied from three weeks to fifteen years. It was under three months in 4, between three and six months in 5, between six months and a year in 7, between one and two years in 7. Only 6 had allowed it to go on longer than this and only 3 had not come for treatment before it was three years old.

Symptoms and appearance are grouped because when terms such as "granulating" and "fungating" appear in the history one wonders how much the house surgeon allowed his eyes to help his ears. With many of the histories either entirely missing or incomplete we find "burning" mentioned once, "itching," "granulating" and "fungating" each twice, "ulcerating" seven times, "pain" six times and the absence of pain specifically noted four times. The physical appearance is described as ulcer nine times, warty, indurated and elevated each six times, cauliflower and nodule each twice, and with a raised edge eight times. Discharge was mentioned eight times, once as absent, once as serosanguineous, twice as watery, and four times as bloody. Any relation to syphilis is not proved, as in 4 cases in which there was a Wassermann report it was negative in all instances.

Four of these patients returned to the hospital of origin with 8 recurrences, making a total of 45 operations. These were described as follows: Excision with Thiersch graft 15, excision with flap 3, excision with primary closure 2, excision with removal of subjacent bone 2, excision with removal of large amount of tissue 3, excision without note as to closure 8, excision, curettement and fulguration 3, excision with full thickness graft 1, and amputation 8. The smallest was a toe, the largest, 4 in. above the knee.

The question of treatment of these patients is an important one. We have two main methods of treating them: surgery and radiation. When I speak of surgery I include removal with the knife, with the so-called radio-knife, diathermy, endothermy, auto-coagulation or whatever you wish to call it. All of these are, or should be, part of the armamentarium of the well equipped surgeon, to be used as his judgment of the exigencies of the case indicate. Radiation, either by radium or roentgen is not satisfactory. Douglass and Culver[5] state that these tumors are more resistant than those of the face; and in this series 5 patients had had previous treatment of this type without success. Unquestionably the best treatment is adequate surgical removal. Cauterization by liquid or paste; or ultraviolet light is of absolutely no value.

Pathologically the series does not bear out the dictum of Volkmann[8] absolutely, although he is in the main correct. Twenty-seven cases were of the prickle cell type, 2 were basal, 1 had a prickle cell on one foot and a basal on the other, and in 7 the

type of cell was not specified. We now come, as we must with all squamous celled cancer, to a consideration of the regional lymph nodes. I have cited 1 case with involvement, and can add 1 more from this series; in which the nodes were removed from 12 patients. Peculiarly enough that case was a basal celled growth but it had been treated with radium. Whether or not this is a case of *post hoc ergo propter hoc* I leave for someone else to decide. Three patients have died to my knowledge; 1 of apoplexy about two years postoperatively, 1, a woman of thirty-nine, about eight months after her first operation and three months after her second, of general internal metastases proved by autopsy. The third, a man of forty-six, two and one half years after operation with an atypical pneumonia which might or might not have been metastatic. Unfortunately no autopsy could be obtained. His nodes did not show involvement at the original operation.

How than are we to treat these patients? Here we have only an 8⅓ per cent involvement of the nodes, in those cases in which they were removed; and a sure 3 per cent and a possible 6 per cent mortality from visceral involvement; both in relatively young patients. We have 1 case which went probably fifteen years and another which went surely seventeen years without evidence of any but local invasion. Shall we then say in all cases, "Let us wait and see whether the nodes become involved later. They rarely do?" Of course if they do we know that the prognosis for permanent cure becomes at once much worse. One case in 12 is a small number but do we wish to take the responsibility of feeling that we might have saved the particular individual who became one of the unfortunate 8 per cent? Shall we make a routine removal in all cases as we do with breast, lip and tongue cancers, with its small but nevertheless definite number of patients who will succumb to the operative trauma? Or can we attempt to use our clinical judgment, and decide from our previous experience which cases will involve the nodes and which will not; endeavoring to steer the patient's ship between the Scylla of metastasis and the Charybdis of operative mortality to the safe harbor of "death from other causes?"

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IMMEDIATE TREATMENT OF
INDUSTRIAL TRAUMA*

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IT is astounding to peruse statistics of industrial accidents and especially to note the number of permanently disabled, and the length of disability from more or less minor traumatic lesions.

The mechanical age, in which machines have to a great extent increased mass production, has added greatly to more distressing disabilities following trauma to careless or inexperienced workers. The larger corporations of the United States have realized the value of preventive measures and have installed devices that tend to lessen accidents. They have appointed efficiency experts whose function it is to oversee the technique of both man and machine. This in itself has not been sufficient, for there is still noted unavoidable trauma. The common procedure, when a man was injured consisted in sending him to the nearest general hospital or doctor, who, in the majority of cases was a young inexperienced general practitioner in need of the small fee collected. It was no wonder that disability was prolonged. Surgeons realize only too well today that early treatment before inflammation has set in will curtail the disability period greatly. The remedy for loss of man power and the time lies with the industrial plant alone. Some of the larger American plants have attempted to correct the time evil by establishing clinics and hospitals directly on the grounds of the works, but unfortunately they have not gone far enough, for frequently one sees a trained nurse or a young general practitioner without hospital experience doing major surgery or through inexperience and haphazard treatment inviting infection and loss of tissue in a very simple injury.

How can this be remedied? As is done in New York City I believe the establishment of traumatic hospitals with ambulance service has greatly enhanced the treatment of trauma. These hospitals of course are manned by traumatic surgeons, the interns or house surgeons have already completed general hospital training and have had special courses in industrial surgery. You should not carry away the idea that traumatic surgery differs in principle from surgery in general.

Most general surgeons are interested in the patients' local trauma and fail to consider his general condition. Time is exceedingly valuable in trauma principally due to the complications of shock and hemorrhage which go hand in hand. The surgeon cannot lay down hard and fast rules as to the treatment of a wounded man, but must correlate his power of observation and apply intelligently his scientific knowledge. When he has treated a vast number of traumatopathies he can frequently tell at a glance and by the taking of the pulse whether the patient is suffering from shock or hemorrhage or both. In general the principles of treatment should be:

1. Control the hemorrhage.
2. Allay mental excitement.
3. Preserve body heat.
4. Stimulate circulation.
5. Conserve tissue fluids and combat acidosis.
6. Intervene surgically at the right time.

The actual technique of treatments I shall not mention for they are quite well known. I may state however that I have used with excellent success radiant heat and diathermy to the liver and splanchnic

areas in cases of shock. Transfusions should not be delayed.

Surgical Procedure. If a patient is deemed a poor risk it is entirely out of the question to perform a complete repair. The surgeon should merely perform that which will preserve life. There are some conditions necessitating immediate surgical intervention, namely:

1. Active hemorrhage from injury to large vessels, including wounds necessitating amputation and penetrating wounds of the abdomen and skull. If one can wait until shock reaction has set in the chances for complete recovery are far greater.

Anesthesia. Ether, chloroform, anesthol and ethyl chloride are strong depressants and the lowering of an already low blood pressure (20 to 30 mm.) may be fatal. Nitrous oxide, oxygen 3 to 1, keeps the patient in analgesia with satisfaction and more safety. Spinal, conductive, regional and local anesthesias are less depressing than ether and chloroform. If gas oxygen is not available an attempt to raise the pressure is essential by means of transfusion or infusion.

Wounds. In the treatment of traumatic wounds the following principles should be observed:

1. Sterilization (chemical and mechanical).
2. Hemostasis.
3. Suture.
4. Drainage.
5. After-treatment.

If there have been any great destruction of tissue and soiling, debridement should be practiced. The wound is prepared by soap, water and peroxide, dried and oily substances removed with benzene or ether. The wound is then irrigated with a solution of boric acid, saline or Dakin's solution if soiling is present. Only dead and dying tissue should be sacrificed. Dissection should be sharp and blood conserved. Unnecessary sponging should be avoided as this irritates tissue. One should attempt to leave a linear scar.

Suture. In clean wounds less than twelve hours old primary suture should be done. Contraindications to primary suture should be:

1. Wounds with great tissue and blood destruction.
2. Fulminating infections.
3. Shock or impending shock.

The one criticism of primary suture is the amount of tissue lost in debriding.

Drainage. Rubber tissue or rubber strips are most efficacious. To the surgeon who is not familiar with primary suture I would suggest delayed primary suture which is to be done within three to five days and which does not add materially to the healing time. Rest to the injured part for two to three days shortens the period of disability greatly. If an extremity is involved, elevation is most important to assist the return flow of blood. Tetanus antitoxin should be given routinely in any case where a punctured wound has resulted from trauma.

Amputations. If there has been marked soft tissue destruction as well as bone destruction with no chance of viability, immediate amputation is essential. If the condition of the patient does not warrant a flap operation a rapid circular should be performed.

Burns. In the treatment of burns the traumatic surgeon should look into the future and the procedure should be determined according to the physical findings. The principles of treatment are:

1. Treat or prevent shock.
2. Care of injured tissue and prevention of infection.
3. Relieve pain.
4. Promote excretions.
5. Stimulate circulation.

The general early treatment is all important, for the severely burned die rapidly from shock. The wound itself should be made painless as rapidly as possible for this symptom adds greatly to the shock. Spraying with novocaine solution, 1 per cent, is most valuable. There are a great many treatments for burns but most traumatic surgeons in America have come

to utilize the old tannic acid method almost exclusively. After the part has been anesthetized and the oily substances removed, a 5 per cent solution of tannic acid is applied and the dressing kept wet. There is complete healing when the tanned surface is extruded. In joint burns it is of paramount importance to prevent contractures by proper splinting.

Dislocations. By far the treatment of choice in reducing dislocations is manipulation under general anesthesia. The sooner the reduction the less time it takes for complete function. There are times when it is difficult to decide whether dislocation is accompanied by fracture. If roentgenrays are not immediately available treatment by suspension and traction should be carried out. The dislocation is frequently reduced spontaneously when soft tissue has relaxed.

Fractures. In the immediate treatment of fractures we must keep in mind that, as time goes on, the spasm increases as inflammation and hemorrhage ensue with the result that reduction is more difficult to accomplish. Delayed, and non-union is favored by loss of time. The first surgeon on the scene should immediately begin reduction by traction either manually or by means of a Thomas or Jones traction splint. It is surprising how rapidly a marked displacement can be corrected by immediate traction. Every compound fracture should be made a simple one through debridement and suture if the compounding is from without in. If there has been a simple spicule puncture, sterilization and sealing with collodium is done. Every compound fracture should be looked upon with suspicion and tetanus antitoxin administered. Our experience in one of the large traumatic hospitals in New York City has taught us to treat practically all fractures of the humerus, femur, clavicle and scapula by means of suspension and traction in bed. We have brought the worker back to his labor in very much less time than by other immobilization methods. After a week of attempted reduction with failure it is always wise to do an open operation. This is especially true of comminuted spiral fractures, interposition of soft parts, fracture dislocations as well as in fractures of the patella, displaced olecranon and displaced condyles. When plaster of Paris is to be used we find that plaster splints are far superior to the old circular plaster, for the circulation is preserved and often an ischemic paralysis prevented, in case marked swelling ensues. Extremities should be elevated to assist the return flow of blood. In most cases, general anesthesia should be used where there is the slightest deformity although if contraindications are met the method of Championniere (massage and heat) often relieves spasm. Local anesthesia with novocaine is quite efficacious if the services of an anesthetist are not available.

Every ambulance and industrial plant should be equipped with all forms of fracture appliances as well as someone who is able to manipulate them.

In conclusion I will leave with you the request that you study the patient as a whole and not treat the local pathology. A live patient with disability is better than a fatality with a perfect wound. Principles for the early treatment of trauma are:

1. Treat shock and hemorrhage.
2. Prevent infection.
3. Preserve tissue.
4. Early resumption of patient's activity.

IMPROVED INSTRUMENT FOR THE APPLICATION & REMOVAL OF WOUND CLIPS*·

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THE multiplicity of methods employed by surgeons in the closure of skin wounds is prima facie evidence that no one ideal method has yet been devised.
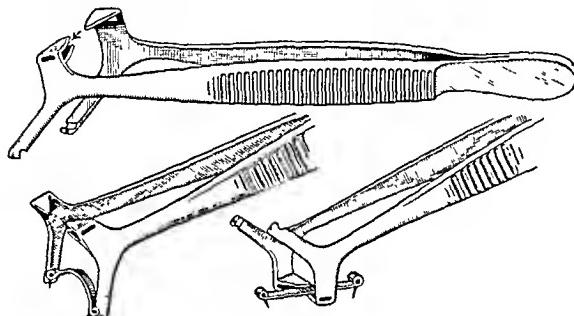
FIG. 1.

Metal wound clips have been in quite general use for more than a score of years and have some distinct advantages over sutures of any kind. The one drawback, discomfort and even pain on removal in some cases, seems to have prevented them from becoming more popular.

From my earliest surgical experience I have been partial to metal wound clips. Years ago I decided that the cause of most of the discomfort during the process of removal was that all the instruments available for this purpose required pressure from one side to insert the tip of the remover under the clip before it could be bent up and removed.

If a clip stood high the remover could be easily inserted and no pain was felt as it was bent out, not the least discomfort was experienced as it was removed; but in many cases the wound clips become more or less imbedded, covered by secretions or folded in a crevice and then the effort to dig the point of the remover in under the clip causes a drag on the clip by pressure from one side resulting in pain.

It seemed evident to me that if an instrument could be devised that would bring equal pressure on both sides of the clip while removing it, thus preventing the pull on the sensitive tissue of the newly formed scar, discomfort would be prevented.

I have used such an instrument now for about twenty years with the greatest satisfaction. The instrument for application and the one for removal are so combined that either can be ready for instant use because it frequently happens that a misapplication is made of a clip which must be removed and reapplied with little loss of time.

Metal wound clips have many advantages over all other methods of wound closure provided the clips are of the proper size and material for the case in hand and that they are rightly applied. They are made in three sizes and the selection of a size for a given case will depend largely on the location where the clip is to be applied and upon the characteristics of the skin of the individual.

For a thin-skinned patient, one with the skin loosely attached to the subcutaneous tissues, the small or medium size should be selected. For some thick-skinned patients and those with much firm subcutaneous fat, the large size is of advantage. The medium size is the most generally useful.

In applying wound clips much depends upon the assistant who must approximate the wound edges carefully with serrated tissue forceps as the clips are applied. The fact that no puncture of the skin is made when wound clips are used prevents the stitch abscesses frequently seen, not only in pus cases but in all too many clean

cases where catgut, horsehair, silk etc. are used to approximate the skin edges.

Where interrupted silkworm gut or other interrupted stitches are used as tension stitches if wound clips are applied between them they prevent the skin edges from rolling under and assure better healing and less scar.

In accidental cuts, especially with children, wound clips are a great boon, for many even extensive cuts and lacerations can be nicely handled without any anesthetic, which would be impossible if needle punctures were required. Then with the removing instrument illustrated, pain is eliminated and the child not having been hurt when the clips were applied submits to their removal without fear.

Another advantage of metal wound clips is that, no matter whether we are on an emergency call to the backwoods or in the most modern hospital, they may be quickly and surely sterilized by passing them through an open flame, by chemicals or by boiling, and they may be resterilized many times without injury.

SUMMARY

It seems to me that metal wound clips that are just right in material and size for the case in hand provide one of our very best methods of skin closure in the great majority of wounds of election and in a very high percentage of accidental wounds.

And now that an instrument is available on the American market for the painless removal of wound clips which combines the instrument for application with that for removal, so that either is instantly available, it should come into much more general use, not only by the surgeon specialist but by the general practitioner who will find it a wonderful convenience in his minor work.

PILONIDAL CYST*

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IT is not the purpose of this paper to present a lengthy treatise on the etiological factors concerned in pilonidal sinus or, more appropriately, dermoid cyst, but rather to recall its underlying pathology and describe the essential steps necessary to effect a radical cure.

We are all aware that in the course of a routine physical examination dermoid cysts are not uncommon, that they occur in many parts of the body, chiefly in the midline, and that, as a rule, they are without symptoms. The patient is often unaware of their presence.

It is not the intention of the writer to discuss the uncomplicated dermoid cyst, but rather to confine his remarks to the infected types which commonly present themselves for treatment and are frequently improperly treated. If we but bear in mind the fact that a pilonidal cyst is simply another term for dermoid cyst and that it can, and does, occur in many places along the midline of the body, I am sure it will help to clarify our knowledge of the pathology underlying this disease. Without a clear conception of the underlying pathology it is not possible to institute the proper treatment for its cure. The relative frequency of dermoid cyst and its congenital heritage are well known, readily recognized, and with few exceptions, properly treated.

It is my intention to deal with the common exception; that is, the infected dermoid cyst or sinus occurring in the sacrococcygeal region. The treatment of the uncomplicated dermoid cyst is the same, regardless of its location, namely, radical excision.

The reasons for concentrating on the infected dermoid of the sacrococcygeal region are the following:

1. Its frequent occurrence in this locality.

2. Its anatomical position, rendering it susceptible both to trauma and transmitted infection.

3. Infected dermoids are rarely found in any other location.

4. Its tendency to chronic sinus formation.

5. The frequent failure of cure, due either to lack of knowledge of the underlying pathology, improper surgical technique, or both.

Etiology. The etiology of the uncomplicated simple dermoid cyst is briefly this: It is a congenital invagination, partial or complete, of the ectoderm with all its appendages. If the included ectoderm is completely surrounded, we refer to it as a cyst; if partly surrounded, as a sinus or fossa. Microscopically, the cyst or sinus wall contains all the true elements of skin, such as a layer of squamous epithelium, supported by a corium with its sweat glands, hair follicles, etc. This skin functions in much the same manner as skin in any other part of the body, and, so, we find in the cyst cavity hair, desquamated epithelium, sebaceous material, and fluid.

We are all aware that many people carry dermoid cysts from birth to old age in this latent state without ever being conscious of their presence. It is only when the added etiological factors of trauma and infection are superimposed that they begin to cause troublesome symptoms. Why we do not see infected dermoid cysts commonly in other regions of the body as compared to those in the sacrococcygeal region may be readily deducted from the fact that a dermoid cyst in this region is subject to frequent local trauma and is anatomically situated so close to the rectum that transmission of infection is easily accomplished. When we add, then, to the simple dermoid cyst the element of infection, the clinical picture changes perceptibly; pain, swelling and

local cellulitis ensue, and one of two things happen, either the patient presents himself for relief, or in the course of time the untreated case finds an outlet much the same as encysted pus in any other portion of the body; that is, by sinus formation. To carry the pathological picture to its fullest, I need not mention that the sinus tracts in such an untreated case may be one or several, that they may find an outlet one inch or several inches from the original cyst, or that they may burrow deeply and widely, leaving the original cyst but a minor factor in the pathological picture. It is wish the treatment of such surgical pathology that I intend to deal, for there is hardly a surgeon who has not been called upon at some time to treat a patient who has not received previous surgical treatment for this condition with unsatisfactory results. There can be but one reason for this, and that is either a lack of knowledge of the underlying pathology or, recognizing that, failure to institute surgical means radical enough to eliminate the existing pathology.

In the larger hospital clinics where the public is better educated to clinical routine and specialties are more sharply divided, patients with infected sacrococcygeal dermoid cysts are usually assigned to or select the rectal surgeon. I can see no sound basis for this, as it is in no sense a rectal disease any more than an infected Bartholin cyst. It is true that its proximity to the rectum makes a differential diagnosis between that an fistula in ano necessary, but the failure of a probe to pass into the rectum readily rules out fistula in ano. In the acute stage pain referred to the rectum is a common symptom, and so the possibility of ischiorectal abscess must always be considered, but the absence of local rectal pain and tenderness on physical examination, as well as the anatomical location of the cyst, makes the differential diagnosis comparatively simple. Nevertheless, by custom, in the larger cities the rectal surgeon is called upon to treat a greater number of these cases than the general surgeon. This is not so in the rural or smaller communities where the general surgeon is called upon to treat all surgical conditions, regardless of location. He, of course, will see a proportionately greater number than the general surgeon in the larger cities. Out of approximately 25,000 admissions for all causes to St. Mary's Hospital, Brooklyn, during the past five years, 25 were for infected sacrococcygeal dermoid cyst or sinus, and about the same number in proportion was admitted to the surgical services of the Greenpoint Hospital, Brooklyn, during the same period. The vast majority of these cases had received previous surgical treatment with recurrence of the condition. The average duration was about three years.

It might be well to note here that many chronic dermoid cysts of the sinus type exist and never seek surgical relief, due to the fact that the symptoms are so few and the inconvenience so slight, that the patients hesitate to subject themselves to any form of surgery. It is only the type with severe acute exacerbations and disabling symptoms that we frequently see.

Pathology. Let me now state in simple terms the pathology presented for treatment in this type of case:

1. The invagination of normal, healthy skin with all its appendages, such as sebaceous glands, hair follicles, etc.

2. An accumulation of sebum, exudated lymph, and hair.

3. Infection introduced into the above media, followed by redness, swelling, cellulitis and all the associated symptom of infection. Trauma usually precedes infection.

4. Sinus formation along the path of least resistance, either down to the fascia of the sacrum or coccyx, or through some weaker spot to the skin surface. Here we must bear in mind that, like all encysted infections, one sinus tract may form, or several, that the sinus tract may be far removed from the original cyst cavity, and so may be one or several inches in length.

Treatment. In view of the above

picture, there is but one method of treatment, and that is radical excision. Incision and drainage are but palliative, never cure, and are justifiable only where the cyst is unruptured and temporary relief is sought. The patient should be advised of the possibility and rule of recurrence. Incision and curettage of the cyst wall is rarely sufficiently complete to accomplish a local cure. With this method we are bound to allow small areas of endothelium to remain, eventually to regenerate and form a new cyst wall.

Carbolization has been advocated by some. I have never tried this method. However, we are all aware that carbolic acid has limited penetrating properties, and in most cases would not destroy the entire corium. To my mind, it has no rational status and would require as much after-treatment, and cause as much pain and inconvenience, as radical excision.

Radical excision is the operation of choice. It eliminates the entire cyst wall; all sinus tracts can be exposed and eradicated. By this method alone can we assure the patient of a good end-result. It has but one draw-back, the time of debility; it requires from three to four weeks to heal. Immediate closure in the face of chronic infection is, of course, out of the question. The cavity must be packed and allowed to granulate in. It is often difficult to convince a patient that what seems to him a comparatively simple infection should require such prolonged treatment. In view, however, of the end-results obtained by other methods, radical excision is the only means by which we can assure him of permanent relief.

Technique. I do not intend to take the space to describe all the details associated with the operative technique. I simply wish to point out what I believe to be a most helpful aid in the excision of these cysts.

Gas-oxygen is the anesthetic of choice. Where this is contraindicated, local field block with 1 per cent novocaine, I have found to work well. The use of field block is limited to the well-localized chronic cases and should never be used in the presence of extensive cellulitis. Caudal block is dangerous because of the possibility of carrying infection into the sacral canal. Low spinal anesthesia is perfectly safe, and is used by many. A rectangular area, completely surrounding and outside the mouths of the cyst sinuses, carried down to the sacrum or coccyx, will give complete anesthesia where local block is indicated.

A 2 c.c. syringe with a small amount, e.g. 1 c.c., of methylene blue, is inserted into the mouth of the sinus, and with gentle pressure allowed to permeate the sinus tracts. Another method that works well is the use of melted paraffin. The paraffin is forced into the sinus tract by means of a 5 c.c. syringe and allowed to harden. When hard, a perfect mould of all sinus tracts enables the operator to dissect with accuracy. Excision begins in the midline, which is always the site of the cyst wall, is elliptical in nature, and carried down to the fascia or the sacrum or coccyx, following with a blunt curved scissors the sinus tracts wherever they lead, until complete excision is accomplished. No attempt is made to close this cavity. Packing is used to control oozing; according to the preference of the operator, iodoform or any other antiseptic packing may be used. I prefer sterile vaseline strip because it eliminates greatly the pain in the subsequent dressings. Repacking every forty-eight hours is all that is necessary, making the subsequent packs lighter and looser as the cavity begins to granulate in from the bottom. It requires about three or four weeks to reach the stage of epithelialization. With the exception of the first week, most cases are able to resume their activities, particularly if they are not of a laborious nature.

◢ EDITORIAL ◣

REWARD AND PRECEDENT

WE are one of that large army of individuals who fail to comprehend many things which are held in sacred reverence by certain honest but pusillanimous people. Often the matter of precedent gives us a robust inward laugh; often, it initiates an exquisite mental pain. Whenever we read in the newspapers or in books dealing with diplomatic sketches of the frenzy caused in the ranks because unintentionally the fifth assistant attache from Graustark slid into the dining-room slightly in advance of the seventh under-secretary from Dreamland (wasn't the precedent established during the reign of King Flubdub that the seventh under-secretary always precedes the fifth assistant attache?), we enjoy a good laugh. But when we read that some one objects to a well-merited reward simply because he is fearful of creating a precedent . . . then, we suffer a great big mental pain. And this was the case when we read in *The Evening Post* of February 22nd "The Daily Mirror of Washington" by Clinton W. Gilbert. The heading is: A Pension Claim That Senator Smoot Is Holding Up.

We quote Mr. Gilbert's article in full:

Washington, Feb. 21.

DR. JOSEPH GOLDBERGER was one of the heroes of medical science. He risked his life many times trying to find the causes and cures of various baffling diseases. He did, among other things, discover the cause and cure of pellagra, thereby saving thousands of lives and millions of dollars in the cost to public institutions of caring for persons made insane by this wasting disease. He did all this on the small pay of a surgeon in the Public Health Service of the United States. He died young, leaving a widow and three dependent children. There is a bill before the Senate to pay the widow $125 a month pension. It has already passed the House, but Senator Smoot is blocking it in the Senate—I suppose, because he does not wish to establish a precedent for pensioning widows of surgeons in the Public Health Service.

If there ever was a case in which the people

of this country owed support to the family of one who worked for them it is the case of Dr. Goldberger. The pension proposed is meager. Money enough ought to be provided to bring the children up properly and educate them. At any rate, it is a poor return for the services Dr. Goldberger performed to allow his family to starve, even for the sake of maintaining precedents.

In the bill which came over the House to the Senate pensions are provided for sixty other persons, all ordered because the persons to be pensioned, or their deceased male relatives, were engaged in the great business of destroying life. Their claims are military. All or nearly all of these pensions will be voted without question. Mrs. Goldberger is the only person on the list who has a claim upon the generosity of the country because her husband made life more livable, less painful, subject to one less horrible disease. And Mrs. Goldberger herself was a heroine of the fight against pellagra. When Dr. Goldberger was assigned by the Surgeon General to study pellagra there was competent medical opinion to the effect that the disease was contagious or infectious. It was necessary to eliminate communicability as one factor in the prevalence of the disease. Mrs. Goldberger had blood from a pellagrous patient injected into her body. Her husband took the same chance with her. The war on disease is a dangerous one. Dr. Goldberger in his investigations contracted yellow fever, dengue fever and typhus fever.

It is hoped that before this sees print ways and means will have been found to give justice where justice apparently is due. If this matter is shelved and gradually forgotten because of precedent, it is to be hoped that some on who reads these lines will be able to keep this subject ever fresh and know the ways and means of again presenting it before the proper tribunals. And may people in control of various channels of publicity appeal to the public at large for fair play.

Precedent! A century does not produce a dozen physicians of Goldberger's size and worth. It would be good business for the government to guarantee an annuity to all the dependents of any and all who do as much for humanity as was done by that quiet, self-effacing government servant, a surgeon in the Public Health Service who died that others might live. Quibbling and splitting hairs over a pension of $125 a month to the widow of a man who saved "thousands of lives and millions of dollars in the cost to public institutions of caring for persons made insane by this wasting disease!"

If this pension establishes a precedent, —then, by all that is righteous let's ahead and establish it.

"But let us gentlemen, get along with the public business. I move you for an appropriation of two millions of dollars for a new post-office in the town of Yapville."

T. S. W.

To the Editor:

I have had brought to my attention an article published in your JOURNAL of the October 1928 issue under the title of, "Extraperitoneal Ureterovesicostomy" by Dr. DeWitt Stetten of New York.

This article materially coincides in facts, principles and illustrations with an article published by me in the *Journal of the American Medical Association*, Vol. 51, No. 16, October 17th, 1908, page 1321.

I am taking this means of bringing the priority work to your attention and to that of your subscribers.

R. L. PAYNE.

Norfolk, Va.

To the Editor:

I am in receipt of a copy of the letter you have received from Dr. R. L. Payne of Norfolk, Va., claiming priority for the operation I described in the October 1928 issue of your JOURNAL, Vol. 5, New Series, No. 4, Page 325, under the title of "Extraperitoneal Ureterovesicostomy by a Simplified Technique for Postoperative Uretero-Abdominal Fistula." I have very carefully gone over Doctor Payne's article in the *Journal of the American Medical Association*, Vol. 51, No. 16, Oct. 17, 1908, Page 1321, and find that the only point of similarity in the two operations is the double slitting of the lower end of the ureter with the creation of two flaps. This is a method which has been in use for many years in all operations for implantation of the ureter into the bladder, and for which I had no intention of claiming any originality. I confess that I did not know that Doctor Payne was the originator of this idea, and am very happy to acknowledge the priority on this particular point to him.

As regards the essential features of the operation which I have described, I find no reference whatsoever to these in Doctor Payne's article. These features consist in incising the parietal peritoneum at the lower angle of the wound, drawing out a peritoneum-covered tongue from the side of the fundus of the bladder through the peritoneal opening, then suturing circularly the parietal peritoneum to the peri-toneum of this tongue of bladder in order to extraperitonealize it and finally implanting the ureter into this extraperitoneal projection of the bladder. The actual method of implanting the ureter into the bladder, whether with lateral slitting, as it seems was originally proposed by Doctor Payne, or without this addition, is relatively immaterial, although I do believe that the lateral slitting is useful in making a firmer anastomosis and in preventing stenosis of the opening. While Doctor Payne has also performed his ureterovesicostomy extraperitoneally, the anastomosis was made at the base of the bladder near the original orifice of the ureter. In the operation I described, I purposely selected the intraperitoneal lateral portion of the fundus of the bladder, which I extraperitonealized in order to overcome the tension that would occur if an attempt were made to implant the ureter where Doctor Payne suggests it should be made, and also to avoid the usually used intraperitoneal and transabdominal implantation, so as to dispose of the danger of peritonitis from leakage and the possibility of secondary intestinal obstruction due to the ureter acting as a band.

DeWITT STETTEN.

New York, N. Y.

To the Editor:

I wish to acknowledge receipt of your letter of the 13th with thanks and again, if consistent with the policy of your JOURNAL, renew my request with you that you publish my recent letter relative to Dr. Stetten's paper.

Neither in my article published in 1908 on "Transplantation of the Ureter into the Bladder" nor at present do I claim any originality. However all the principles in Dr. Stetten's paper published in your JOURNAL of October 1928 was so thoroughly and completely covered in my original article, that I think it is only fair that this should be brought to the attention of your readers through the pages of your Journal, especially since Dr. Stetten seems to be entirely unfamiliar with my work and numerous similar papers since published by other authors.

The extraperitoneal operation, in my opinion, is the only one to be done in these cases, whether the anastomosis is made into the posterior wall of the bladder or the lateral aspect and I see no sound surgical excuse for opening the peritoneum or using the peritoneal surface of the bladder as suggested in Dr. Stetten's article.

R. L. PAYNE.

Norfolk, Va.

To the Editor:

I wish to acknowledge receipt of your letter of February 21st, with a copy of Dr. R. L. Payne's second letter in reference to my article in the October 1928 number of your JOURNAL on "Extraperitoneal Ureterovesicostomy."

In reply thereto I wish to say that I too have made no claim for any great originality in this operation, except that I feel that I have devised a safe, simple and effective method of implanting the ureter into the bladder by an extraperitoneal route without tension, and, that as far as my search of the literature reveals, this particular technique has never before been described. It is quite true, as Doctor Payne states, that the principle of extraperitoneal ureterovesicostomy is not new, but this same statement holds largely for practically every advance in surgical technique. Most such advances are based upon old and established principles and are merely improvements upon methods that have been previously used. In spite of Doctor Payne's contrary opinion, I believe that the method I have advocated is a distinct improvement upon the plan that has been in use hitherto, and which he seems to advocate. The use of the peritonealized surface of the lateral portion of the fundus of the bladder permits of a much firmer anastomosis and does not produce as great a tension at the suture line, as when such an anastomosis is made at the non-peritonealized base of the bladder. The opening of the peritoneum can only be regarded as a theoretical objection, as the peritoneal cavity is immediately closed by a circular suture between the parietal peritoneum and the peritoneal-covered portion of the bladder.

DeWITT STETTEN.

New York, N. Y.

J. MARION SIMS

[1813-1883]

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

J. MARION SIMS, M.D., LL.D.*
SURGEON AND HUMANITARIAN

Dougal Bissell, m.d., f.a.c.s.

NEW YORK

MARION SIMS is a good example of a large group of men who showed no brilliancy at college, but who, through self-culture, developed wonderfully their latent talents; a class in which thirst for knowledge is awakened not by living in cloistered, scholastic halls, but by personal experiences with their fellow men. His consciousness of having failed in College to cultivate self-expression by means of written words led him into great embarassment when the opportunity came to record his first great surgical achievement, and it was with so much chagrin he beheld his first printed article, that he immediately hid it in a medical book, where he hoped that it would remain and never again disturb him. It was this article, however, which introduced him to the scientific world as an original thinker and successful operator; but, as life's conflicts increased, he acquired more and more confidence, and at last he awoke to the realization of the fact that, to succeed in the war he was waging, words were essential. It is then we find him not at a loss for these weapons, nor lacking skill in their use.

Sims was not prolific in his contributions to literature; including his autobiography and addresses, they number only about thirty. Some of them are ordinary, but others are well expressed and well constructed and most of them contain brilliant conceptions. His autobiography does not do him justice from a literary standpoint[1] and he might easily be misinterpreted, if one were inclined to be hypercritical, for we find him saying: "Simple and beautiful methods I have discovered." Throughout the book he constantly speaks in this way, but all records of his life show that he was particularly modest and free from conceit. The remarks of the character referred to were, in reality, not outcroppings of egotism, but expressions of intense love of truth and beauty, and were said in the spirit of one who, in an ecstasy of delight on discovering a beautiful creation of nature, expresses himself with no consideration of self as the discoverer. Again he said, contemplating the result of his work, "Could anything be more beautiful?" Here he reminds one of a painter who has produced a real work of art, knows it and is in love with it, not because *he* has produced it but because in reality it is beautiful, and he is jealous of

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[1] In justice to Sims, it should be said that he died before completing his autobiography, and therefore had no time to review it.

* Read before the South Carolina Medical Society of Charleston, Nov. 22, 1927.

it, chiefly to preserve it. I have no doubt that creating gave Sims unbounded pleasure, pleasure which was based upon the satisfaction of having accomplished something, something in which he first saw hope, then evidence of relief to suffering woman. It was this, above all the emotions which overwhelmed him, that made his work beautiful to him.

Sims was not a reckless surgeon, as many of his enemies tried to make it appear. He may at times have seemed so, because he blazed the trail or ventured in unfrequented paths, but, by analyzing his work, it will be found that every step he took was the result of logical thinking, and his boldness was always within the limits of reason. A good example of clear thinking and brilliant action, also of a well-developed ethical sense, is found in his very early professional life, when he was confronted with a surgical problem which his confreres had hopelessly attempted to solve. In this instance we find his mind driving straight to the source of the disease. Others had considered it a medical case, he a surgical case, but not wishing to seem unduly bold, he insisted upon consultation. The illness had been of long duration and practically every physician within the radius of one hundred miles had already been called for advice. His examination convinced him that there was a deep-seated swelling in the region of the liver, and that fluctuation could be detected. He felt that the responsibility should be shared and, remembering that within a day's journey there was located a young physician who had had the same advantages he enjoyed in Philadelphia, suggested him for consultation. The meeting ended, unfortunately, in a disagreement. The patient accepted his advice and the bold operative venture was rewarded with immediate relief and eventual cure.

Who can read, without a feeling of profound admiration, the story of his meeting with the hideously repulsive woman, whose facial deformity compelled her to wear a dark veil of double thickness, to prevent even her own family seeing so repellent an object. She approached him with but little hope, but he calmly told her that he could cure her deformity. He knew that a surgical effort to cure her would be a tremendous venture, but he also felt that for him not to attempt it would be cowardly. Sheer audacity seems the only word fitted to describe the position he assumed. His stand was the result of surgical confidence acquired from experience, and his effort ended in a brilliant success. The reconstruction not only gave the woman a presentable appearance, but permitted the placement of an upper set of teeth, with which nature had not provided her. The success of this combined restoration forced Sims, through the insistence of his friends, into the first publication already referred to.

Sufficient has perhaps already been said to show that Sims was self-reliant, logical in reasoning, direct in action and that his contributions to surgery were noteworthy; but there stands out boldly a surgical masterpiece, created in Paris in 1878, which warrants a high place for him among the general surgeons of history.

On April 18, 1878 Sims, while in Paris, operated upon a woman with a tumor in the right hypochondrium. His diagnosis was a cyst connected with the liver, whether hydatid or "dropsy of the gall bladder" he could not say. One month before operation he advised aspiration as a means to guide subsequent treatment. This was done with relief to the patient and with the attainment of information regarding the tumor. The relief, however, was only transient, but proved sufficient to encourage the undertaking of a more radical step, namely, the opening of the gall bladder and the making of a permanent fistula for drainage. The following is his line of reasoning in arriving at this decision.

Firstly, we saw much improvement in all her symptoms following the temporary removal of the fluid by aspiration; secondly, it would be an imitation of the efforts of nature in all

such cases where recovery has taken place; and thirdly, speedy death was inevitable if we did nothing.

On the date given he performed the first cholecystotomy recorded, and gave the name to this operation by which it has ever since been known.[2] Although the patient died on the eighth day, necropsy showed that death was not due to peritonitis. Sixty stones were removed at the time of the operation, sixteen more were found at autopsy, secluded in the lower part of the gall bladder, which accounts for the failure of their removal at the time of operation. Death occurred "from passive internal hemorrhage, the result of the poisonous effect of the biliary salts on the blood." Further to sustain his position he argues.

This case proves that it is not necessary to wait for the tedious efforts of nature, on the one hand, nor to resort to the clumsy process of caustics on the other. The propriety of the operation being established, we can hereafter resort to it at an earlier period, before the changes are effected in the blood by the bile acid which leads to its extravasation from the mucous membrane.

Dr. Samuel D. Gross, a contemporary of Marion Sims, and at that time America's leading surgeon, relates that, during his early student life, he read an account of a consultation where a patient who had had an aneurysm was advised by his physician to go to Philadelphia for an operation. He pondered over this and wondered why a physician sent so interesting and important a case away. Then it dawned upon him that the physician might have considered himself incompetent, or did not have the courage to undertake the work. From that moment Gross determined so to equip himself as to be able to meet every emergency and never to send a patient away. In the attitude Gross here assumed, it is at least suggested that he thought that every graduate of medicine

[2] Reported without the knowledge that Dr. Bubbs of Indiana had preceded him in operating, by a few months.

should be prepared to solve every problem which might arise. His ambition to treat and cure all ailments of men was laudable and perhaps no man was better equipped to meet surgical problems, according to the knowledge of his day than he eventually became, for he led the America vanguard of general surgical thought, knowledge and skill; but able as he was, he must have been constantly confronted with impassable barriers. Sims, in contrast, was not a student, in fact, had but little opportunity to read, even had he been so inclined. He depended more upon the surgical principles acquired from the practical training of Dr. George McClellan, also Gross' instructor, combined with his natural ability to solve unfamiliar or altogether new surgical problems, than upon suggestions from personal contact with advanced thinkers, or through current literature. His was the bold mind. His guiding star was that of the pioneer, who dares to venture into the unknown, equipped with natural endowments and a few acquired principles of his calling.

Gross advanced along general lines. Sims became particularly interested in solving seemingly impossible individual problems, which eventually directed him into the conquest of a special field. The surgical world needed both of these men, vastly different though they were in intellectual attainments.

Life and work were synonymous to Sims, but his greatest ambition, outside of his unquenchable desire to help humanity, was to teach others, so that those taught might carry on. There is no brighter page in the annals of American Surgery than that which relates to his enlightening surgical conquest of France, Belgium and England. He succeeded in curing 'many gynecological cases which had previously defied the efforts of Europe's greatest surgeons. He acquired the confidence of the scientific men and of royalty and was elected to membership in their scientific societies and awarded decorations. His early struggle in New York City to establish

himself as a teacher was heartbreaking, but he eventually succeeded. By his enthusiasm, energy and tenacity of purpose, in the face of sickness and persecution, Sims won the sympathy and interest of a small but influential group of men and women; by his personality and scientific achievements he gained their confidence and stimulated the building of the Woman's Hospital, an institution which has been far reaching in its beneficent influence in the restoration of woman to health, and which today is a living and growing monument to his great genius.

It is almost half a century since Sims passed from the field of surgical work. Is this lapse of time sufficient to give a proper perspective for study? Are we able now to estimate the man in his varied capacities? Can we measure his skill and its results, the height and breadth of his mind, the depth of his soul? Properly to estimate the value of his work, the conditions under which surgeons then performed their daily tasks must be taken into consideration. Sepsis and asepsis were unknown terms. Neither Holmes nor Semmelweiss had as yet stirred his prolific brain to suggest the probability of a hidden, minutely small, but communicable poison. The great Pasteur had not yet promulgated his bacterial doctrines, and Lister was still talking about laudable pus. The silk suture, then in universal use, was by its capillary action a harborer of bacteria, and the mechanical factor, particularly in the vesicovaginal field, in preventing primary union; but, with the silver suture, Sims defied the laws of local inflammation and thus reached his goal.

The single-blade speculum, though original with him, had, in varied forms, been previously invented. The perfection of it was enough in itself, however, to put the profession under lasting obligation to him, for Recamier's cylindrical instrument, then in vogue, did not permit of surgical access to the genital canal, except in a very limited way. The Sims' position, while in reality merely a variation or modification of positions already used and of but limited use today, was in his day an important factor in making his achievements possible and, with the speculum, is further evidence of his genius.

Our estimate of him as a surgeon must therefore be based upon the fact that his achievements were in the preaseptic days, and that he combatted successfully hidden forces against which the conflict seemed hopeless until he made practical his rediscovered weapons of defence.

Sims was intensely human, with faults, but no dishonor of soul. His life was active and colorful; but, in commenting on his personality in an address of this character, we are of necessity confined to characteristics which are reflected from his varied professional contacts and experiences. Some of his conspicuous traits have already been dwelt upon. His sense of chivalry was exhibited on many occasions, but one with international flavor is of particular interest. When France faced Germany in 1870 Sims offered her his professional services and was made Chief of Staff of the Anglo-American Hospital Corps at Sedan. For this service the grateful Republic conferred upon him the Order of Commander of the Legion of Honor. But, while his love of France glowed bright and constant within him, his love of humanity was not thereby lessened, for his medical services were given alike to friend and foe as testified to by one thousand grateful Germans.

In 1876 Sims, while operating on the daughter of Dr. P. A. Wilhite,[3] was informed of the history of Dr. Crawford W. Long's very ·early application of ether-anesthesia and of the five surgical operations he performed while the patients were under complete anesthesia. This startling discovery so played upon his sense of truth and justice that he began an analytical study of the history of ether-anesthesia, which ended in his writing an address in which he championed

[3] Wilhite was the first completely to anesthetize a person by ether, though done unintentionally.

the claims of Dr. Long. Though bitter in his denunciation of the unethical methods of Morton, who was four years later than Long in the use of ether as an anesthetic and whose motives were chiefly to commercialize his secret remedy, "Letheon," yet he was willing to accord him justice for having made it possible for ether anesthesia to have been so early popularized through Drs. Warren, Hayward and Bigelow of the Massachusetts General Hospital, and proposed that Congress award the families of each contestant for the honor of priority, by an endowment of $100,000; and further, that a national monument be erected to the American discoverers of anesthesia and that the names of Long, Wells, Morton and Jackson be inscribed upon it.

One of the saddest episodes in Sims' life, and one he regretted perhaps more than any other, was his voluntary but eventually forced resignation as Surgeon to the Woman's Hospital. No event in his career shows more plainly his human side. Indignant at the failure of his colleagues on the surgical board to support him in his objections to the ruling of the Board of Governors, which debarred all cancer cases from hospital care and restricted the number of spectators at operations, he arose in the midst of an annual meeting of the officers and friends of the institution, and poured out his injured soul in eloquent defence of those afflicted with cancer[4] and in scathing criticism of a rule which limited the number of visitors at operations. His impetuous nature spurred him on at an untimely moment to champion a just cause, and he went down to defeat. He recognized his indiscretion, his tragic mistake, and, with the courage of a true nobleman, he did all that could be done to make amends. He apologized and admitted that his criticism was "in violation of good taste and propriety." His spirit was saddened, but his soul was unconquered; he forgave his enemies but was not by them forgiven.

[4] Sims introduced the use of chloride of zinc in the treatment of inoperable cancer.

Although Sims cannot be ranked as a superman, the principles of whose discoveries are essential to the development and continued progress of science, yet his place as a thinker and doer who advanced science many years is assured, for he reaped a harvest of relief from pain and suffering such as few have before or since his time. He was fundamentally one of moral fiber, sensitive and refined, gentle as a woman, jealous of truth, with a spirit of philanthropy and brotherly love akin to that of Joshua Ben Joseph.

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BOOK REVIEWS

We are living in an age when industrial or traumatic surgery is of paramount importance. It is important because it differs from the surgery as taught in medical colleges, because it has a direct relation to industry and, also, to the future usefulness of individual members of society.

And so Doctor Forrester's work[1] is timely and a much needed addition to the surgical literature of the day. Many surgeons of more than average ability, because of a lack of opportunity to see great numbers of traumatic surgical cases and the proper understanding of this phase of surgery commit many blunders and get poor end-results.

[1] Imperative Traumatic Surgery with Special Reference to After-Care and Prognosis. By C. R. G. Forrester, m.d., f.a.c.s., N. Y., Paul B. Hoeber, Inc., 1929.

Doctor Forrester, who is a recognized expert in this surgical field, covers his subject thoroughly. There is no padding. He shoots for the bull's-eye and hits the mark.

After the introduction the main chapter headings are: Preliminary Examination of Patient for Operation; Roentgenology in Traumatic Surgery; Injuries to Head; Traumatic Arthritis of Shoulder with Ultimate Fibrosis; Fracture of Clavicle; Injuries of the Scapula and Humerus; Injuries of Elbow, Radius and Ulna; Injuries of Wrist and Hand; Injuries of Ribs; Spinal Injuries; Injuries of Pelvic Region; Dislocation of Hip;Injuries of Femur; Injuries of Knee; Injuries of Tibia and Fibula; Injuries of Ankle; Injuries of Foot; Treatment of Compound Fractures; Surgical Interference in Treatment of Fractures; Surgical and Non-Surgical Treatment of Injuries to Peripheral Nerves; Osteomyelitis; and Index.

The 598 illustrations and charts have a distinct bearing on the text and have not been placed at random to give the book a "good appearance." Every surgeon, especially the one doing industrial surgery and he who sees a great deal of traumatic surgery, and the general practitioner who is open to the first call to treat traumatic surgical conditions, will find a wealth of information in Doctor Forrester's book. It is a valuable addition to present-day surgical literature and practice.

OPERATIONSLEHRE[1] is the first volume of a new and comprehensive work on operative surgery by the directors of the surgical clinics at Königsberg. Principles and technique are the foundation stones on which this work is built. Step by step from the reception of the patient to the removal from the operating table, the ground is covered with old-fashioned German *Gruendlichkeit*. Seven hundred and nine thoroughly satisfying half-tone illustrations, most of them colored, within the space of 621 pages is in itself an indication that the progress of each operation is thoroughly illustrated. Ingeniousness is shown in the use of superimposed colors, so that one figure may be interchanged to illustrate various points.

Bibliographic references are omitted and what quotations are made are mostly from German clinics. The work would seem to cover completely and thoroughly the technique at

Königsberg and this is of particular interest. Space is taken to illustrate instruments but it must be admitted that the arrangements shown and the suggestions made are thoroughly practical.

The use of color has been carefully planned, has a definite purpose in each instance and is not made merely for typographic effect. The paper, typography and press work are all that can be desired.

The price of over $25.00 for one volume of an operative surgery is a bit appalling. Examination of the actual volume with an idea of the cost of production makes this price on the face of it perhaps defensible. On the other hand, it would seem that the very price would necessarily limit the circulation of a book which on its merits should be in the hands of every surgeon. Compared to our American publications this price seems extraordinarily high; however, the production of a book like this in this country would probably be out of the question on account of its very cost. The question of whether such books had better be published without consideration of their selling price is debatable. For those who cannot afford them, they would at least be available in the libraries. To this problem the reviewer has given much thought and has been unable to reach a definite conclusion. It is hoped that this may be discussed by readers in the correspondence columns of THE AMERICAN JOURNAL OF SURGERY.

The author of this work,[1] formerly professor of pathology at the University of Budapest, handles his subject with typical European thoroughness. The seven chapter headings indicate the comprehensiveness of the work: The Development of the Adrenals; Anatomy; Physiology; Pathological Anatomy; Pathophysiology of the Adrenals; Organotherapy; Bibliography. To a thorough knowledge of the literature the author adds his own conclusions, based on many years of laboratory work. The present monograph is an elaboration of a work published by the author seventeen years ago. Goldzieher's statement that "the more knowledge we are accumulating on the function and on structural changes and functional disturbances of the individual endocrine organs, the more we realize the dependence of each of these organs upon all the rest," is not to be gainsaid and we must also agree with him that

[1] OPERATIONSLEHRE: Allgemeine und Spezielle Chirurgische. By Dr. Martin Kirschner and Dr. Alfred Schubert. Berlin, Julius Springer, 1927.

[1] THE ADRENALS: Their Physiology, Pathology and Diseases. By Max A. Goldzieher, M.D. N. Y., The MacMillan Co., 1929.

"it seems futile to discuss, for instance, the function of the thyroid gland and its disturbances without considering simultaneously the changes and the interference of the adrenal, the thymus, the gonads and possibly that of all the other endocrine glands." Accepting these statements as the basis of the text and in view of the author's standing it is readily seen that the book will be found invaluable by every student of endocrinology. In this classification should be included practically every physician and surgeon today. The text ends with a bibliography of 100 pages divided as the chapters. A good index closes the book but it is unfortunate that an author index is not included, for unless one knows which phase an author has covered there is difficulty in finding the references in the bibliography.

The subject matter of this book[1] is described by its title. It is a thoroughly conscientious and fairly complete monograph covering the entire subject and heartily recommended to all physicians reading French.

The technique of gall-stone operations is thoroughly discussed in this book[2] and the anatomical part by Dr. Schumacher of Vienna is an invaluable addition. The illustrations are, in the main, photographs, with some line cuts and with the addition of color wherever necessary to demonstrate distinctly the points made. The two-page table of contents gives a thorough insight into the subject matter of the book. But it is to be regretted that no index is added, a fault we so often find in German and French works otherwise so splendid. It would really seem that in a book of 240 pages with 108 illustrations, selling for $9.00 the reader might reasonably expect a complete index.

[1] La Diagnostic Dans Les Affections De La Colonne Vertebrale (Chez L'Adulte). By P. Oudard, A. Hesnard and H. Coureaud. Paris, Masson et Cie, 1928.

[2] Die Technik der Eingriffe Am Gallensystem. By Dr. Peter Walzel. Einem Topographisch-Anatomischen Teil by Dr. Oskar Schumacher. Wien, Julius Springer, 1928.

No better review of this book[1] can be written than to quote in full the foreword by Dr. Elliott P. Joslin as follows: "The surgical diabetic has been the serious diabetic, the diabetic who died. This is still true and to an extent ever must be, because the surgical diabetic is the one with the most complications. Yet insulin and concurrent surgical and medical effort have won unlooked-for victories. It will be easily understood, therefore, that I, and indeed many of my patients as well, have watched the compilation of this book during these last few years with deep interest. What a blessing it has been to have two young zealots working over my cases, striving to make the result of each fresh and surgical encounter more successful than the last! And now it gives me pleasure to see their experience made available for all." With such an introduction there need be no hesitancy in recommending this book to every surgeon who either has or expects to operate on a diabetic patient.

Any author who produces a book[2] for the medical profession that will make the reader think is entitled to credit. And this Dr. Ibotson has certainly succeeded in doing. To agree with all statements in the twenty-two chapters would be asking too much but there is not one of them that is not stimulating. The author protects himself against criticism in his preface by saying: "I am merely endeavoring, as far as I am able under my conditions, to make a beginning of the collection of such facts, hoping that others will expand them and that the subject may bear fruit." A wide circle of readers for this book will undoubtedly lead to further research which, in turn, must undoubtedly "bear fruit." Whether we agree with the author's conclusion or not this is a book to be read and re-read and not to be laid aside lightly.

[1] Diabetic Surgery. By Howard F. Root, m.d., and Leland S. McKittrick, m.d., f.a.c.s. Phila., Lea & Febiger, 1928.

[2] Partnerships, Combinations and Antagonisms in Disease. By Edward C. B. Ibotson, m.d. Phila., F. A. Davis Co., 1929.

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WHAT HAS HAPPENED TO THE UNOBSTRUCTED BOWEL THAT FAILS TO TRANSPORT FLUIDS & GAS?*

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WHAT has happened to the mechanism of peristalsis when an unobstructed bowel fails to pass onward its contents? Is the intestinal muscle poisoned or injured, is it paralyzed or inhibited or is it still contracting in some incoordinated way? Before one attempts to answer these questions one must have some idea of the way in which food and its residues pass through the normal bowel.

THE MECHANISM OF NORMAL PERISTALSIS

It will be recalled that there are three main types of activity in the small bowel: first, local swaying movements or rhythmic segmentations which serve to knead the intestinal contents and to mix the food with the digestive juices; second, slow changes in tone; and third, peristaltic rushes which sometimes run from the stomach to the anus, carrying more or less material before them.

It should be remembered also that all these activities continue after degenerative section of the vagi and splanchnics, and that the first two and possibly the third continue even after removal of the bowel from the body.[4] Bits of intestinal muscle cut out and suspended in oxygenated Locke's solution will contract rhythmically for hours at a time, and the fact that they will sometimes beat more regularly on the third day after excision than on the first suggests strongly that nervous ganglia have little to do with the phenomenon.

Effects of Removing Nervous Inhibition. The digestive tract, then, is highly autonomous, so much so that it seems unlikely that a withdrawal of nervous stimuli could ever produce paralytic ileus. It is more probable that postoperative ileus would be produced by a stream of inhibitory stimuli arising in the brain or cord or in tissues cut and injured during the operation. In animals with the abdomen opened under salt solution, the bowel usually remains quiet until the distal two-thirds of the dorsal cord is destroyed or the splanchnic nerves are cut.

Rabbits with the vagi or splanchnics or both cut, and most of Auerbach's plexus degenerated, have such overly active intestines that many develop diarrhea and apparently die of inanition. The animals eat, but the stomach and cecum empty so rapidly that sufficient time is not allowed for digestion and absorption.

But even when the intestinal muscle is paralyzed or inhibited it is hard to understand why it should so completely fail to pass onward its contents. Alvarez has published records showing the seepage of fluids through the bowel in the absence of

* Submitted for publication February 18, 1929.

rush waves,[5] and dogs will go on living and digesting after the removal of all the muscle from long segments of bowel.[16,20,21]

What then goes wrong in cases of dynamic or paralytic ileus and what is the extra handicap that puts a stop to all movement of material through the bowel? Some observations we have made on the behavior of the excised digestive tract of rabbits suggest that this stoppage might be due at times to a tendency of the denervated bowel to cramp down and resist the passage of liquids and gas. This cramp-like contraction might be brought about not by an increase in nervous activity but by a decrease: a decrease similar to that responsible for spastic paralysis in arm or leg.

At other times the obstruction appears to be produced by gas which causes the bowel to become packed tightly in the abdominal cavity. Normally the innumerable kinks do not produce obstruction, because rush waves, traveling rapidly, push material ahead of them with such force as to distend the loops and straighten them; but as will be shown later, in sickly animals or animals with an abscess about the ileocecal sphincter, the rushes travel so slowly and hesitatingly that it does not take much to stop them.

Why Food Goes Caudad through the Bowel. Whatever the mechanism is that is responsible for the caudad progress of food, it must be built into the structure of every inch of the bowel because when short segments are cut out, turned end for end, and the continuity of the gut restored, the direction of peristalsis in the reversed segment remains unchanged; liquids can be forced through but solids will not pass; they accumulate at the upper anastomosis and eventually kill the animal by blocking the lumen of the bowel.[3]

Every segment, then, in a normal bowel is so constructed that peristaltic waves tend to go over it more easily in one direction than in another. The condition resembles that present in certain worms in which the "polarization" is so perfect that if the animal is cut into many small pieces they all crawl in the same direction toward the point where the head used to be.

Gradients. The next question is: What causes the polarization? Whatever it is it must be graded from the duodenum to the lower part of the ileum or it would not be demonstrable in every segment. Actually Alvarez and his associates, while studying the physiologic properties of intestinal muscle, found many graded differences in irritability, rhythmicity, tone, latent period, muscular strength, and metabolic rate. Their studies show that just as in the heart, so in the bowel, waves begin in the region of highest rhythmicity and run to the region of lowest rhythmicity.[3]

If these graded differences account for the direction taken by peristaltic waves, it follows that if the metabolic rate and the irritability of the ileum were to be raised in any way, as by the presence of inflammation, the gradient of forces might be so flattened or reversed that the bowel would transport material caudad no better than it ordinarily transports it orad. There might be active kneading movements in such a bowel but no more transportation of material than would be seen in a level ditch. Furthermore, if toxins of disease should injure the sensitive duodenum more than the hardy ileum, they would upset the gradient of forces by weakening the pumping power at the upper end.[6]

That irritation of the lower end of the bowel will slow the progress of material coming toward it was shown by Hedblom and Cannon, and White when they irritated the cecum by injecting into it a few drops of croton oil. It is well known that in acute ileus the bowel for some distance above the obstructed and highly irritated segment is empty; food residues are held back in the duodenum and jejunum, and if enterostomy is to do any good the opening must be made far orad in the region of the gut where material has accumulated. If on the other' hand the obstruction is produced slowly and without irritation of

the muscle, as by a carcinomatous ring, the intestinal contents may pack up against the obstruction and, as we have seen in animals, it is the segment just above the block that is distended.

These observations are all explainable on the basis of the gradient theory and the law that Alvarez associates with it, namely, that irritation of the bowel at any point tends to hold back material coming down from above and tends to hasten the progress of material that has passed.[2] The rapid progress below an irritated segment will sometimes produce diarrhea, but often this hastening effect is obscured by the restraining action of the ileocolic and anal sphincters.

EXPERIMENTAL WORK

Several years ago Alvarez and Mahoney began work on the series of experiments here reported. They hoped to produce dynamic ileus or something corresponding to the reversal of intestinal peristalsis that is seen in acute appendicitis in man. In some of these cases, such large amounts of intestinal fluid are vomited at frequent intervals that there can be little doubt about the reversal of the gradient of forces in the bowel.

Unfortunately almost all the work done on ileus so far has been directed toward the elucidation of the cause of death, and the time has come when some attention should be paid to the disturbed mechanics of the bowel.

Crushing and Cutting the Bowel. Alvarez and Mahoney first opened the abdomens of rabbits under ether anesthesia and lightly crushed a segment of ileum in the jaws of a clamp. The lumen of the bowel was left unobstructed, and the abdomen was closed. A few hours later the animals were again anesthetized, the spinal cord distal to the fourth dorsal segment was pithed, and the abdomen was opened under a bath of warm salt solution. The bowel immediately above the injured and hemorrhagic band was generally found to be empty, and the only loops distended

with fluid were found in the duodenum or jejunum. The bowel below the band was generally empty. At intervals, waves could be seen pushing material down toward the bruised region but as they approached it they either faded out or were met and blocked by short reverse waves.

The Injection of Irritants into the Ileocecal Region. Rabbits were anesthetized, the abdomen was opened, and a few drops of turpentine were injected into the wall of the bowel about the ileocecal sphincter. After an interval of from one to five days, the abdomen was again opened in a bath of warm physiologic salt solution and with the help of small wire clips and threads running to light levers, simultaneous records were obtained of the activity in six or more regions of the bowel.

The injection of the irritant material produced necrotic areas and small patches of peritonitis. The bowel for some distance above the injured region was empty and very irritable, and the duodenum and upper jejunum were commonly distended with a greenish fluid which they were unable to move onward. When the injury to the ileocecal region was sufficiently severe the animals suffered with diarrhea and the colon and cecum were empty.

In these animals the normal rush waves that from time to time run down the bowel either failed to appear or else were infrequent. Only with difficulty could they be produced with the usual method of injecting water into the mouth or esophagus. These rushes often faded out after going a short distance, or their advance was blocked by ring-like contractions which appeared here and there.

Normally, peristaltic rushes seem to gather momentum as they go, so that they travel faster in the ileum than in the duodenum. With a flattened gradient or one reversed at the lower end one would expect the rushes to travel more slowly than usual, especially in the lower part of the ileum, and actually such slowing was often a striking feature in our records.

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rush waves,[5] and dogs will go on living and digesting after the removal of all the muscle from long segments of bowel.[16,20,21]

What then goes wrong in cases of dynamic or paralytic ileus and what is the extra handicap that puts a stop to all movement of material through the bowel? Some observations we have made on the behavior of the excised digestive tract of rabbits suggest that this stoppage might be due at times to a tendency of the denervated bowel to cramp down and resist the passage of liquids and gas. This cramp-like contraction might be brought about not by an increase in nervous activity but by a decrease: a decrease similar to that responsible for spastic paralysis in arm or leg.

At other times the obstruction appears to be produced by gas which causes the bowel to become packed tightly in the abdominal cavity. Normally the innumerable kinks do not produce obstruction, because rush waves, traveling rapidly, push material ahead of them with such force as to distend the loops and straighten them; but as will be shown later, in sickly animals or animals with an abscess about the ileocecal sphincter, the rushes travel so slowly and hesitatingly that it does not take much to stop them.

Why Food Goes Caudad through the Bowel. Whatever the mechanism is that is responsible for the caudad progress of food, it must be built into the structure of every inch of the bowel because when short segments are cut out, turned end for end, and the continuity of the gut restored, the direction of peristalsis in the reversed segment remains unchanged; liquids can be forced through but solids will not pass; they accumulate at the upper anastomosis and eventually kill the animal by blocking the lumen of the bowel.[3]

Every segment, then, in a normal bowel is so constructed that peristaltic waves tend to go over it more easily in one direction than in another. The condition resembles that present in certain worms in which the "polarization" is so perfect that if the animal is cut into many small pieces they all crawl in the same direction toward the point where the head used to be.

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sign of back-pressure. In some it was due to the fact that the lesion had not been made sufficiently irritating but in others the cause was not discernible. Perhaps in some the original gradient of forces down the gut was so steep that it could not easily be reversed, and it may be that such robust health can account for the fact that there are persons who in spite of the presence of such irritating lesions as a ruptured appendix can continue for several days to eat and digest with hardly a symptom of reverse peristalsis.

Occasionally reverse waves were seen to run orad a short distance from the injured region. These waves were particularly marked in an animal that had been pregnant and that aborted when the injection was made into the ileum. In this animal the back-pressure was so marked that at no time during the day could the distended duodenum empty into the jejunum. Even in the stomach the waves faded out before they reached the pylorus and some were reversed.

The local segmenting movements were sometimes active and sometimes quiet just as they are in "normal" animals.

For controls a few rabbits were etherized, the abdomen was opened, and the intestines were handled. A few days later when the abdomens of these animals were again opened the bowel behaved normally and many spontaneous rush waves were seen.

WHAT BRINGS ABOUT THE BACK-PRESSURE?

Having demonstrated that irritation of the lower ileum can produce back-pressure in the small bowel, with slowing or stoppage of peristaltic rushes, the next question was: What changes take place in the wall of the gut to explain the phenomena observed?

Rate of Rhythmic Contraction. The gradient in the rate of rhythmic contraction was reversed in only 2 out of 26 experiments. Apparently this gradient is not so closely related to some other basic gradient, perhaps of metabolism, as we

once thought; and as we shall soon show, the irritability of the gut is probably a better index to the changes that take place in disease.

Irritability of the Bowel. We have found that normally the irritability of the bowel is graded from the duodenum to the ileum. The duodenum responds to the faradic current when the secondary coil is out 11 or 12 cm., while the ileum responds with the secondary coil at 9 cm. In the animals with the irritated ileum the whole bowel was unusually sensitive but since the increase in irritability was more marked at the lower than at the upper end, and since in some cases the duodenum lost in irritability at the same time as the ileum gained, the usual gradient down the bowel was reversed.

This reversal was the most striking and perhaps the most important observation made during the study. Its importance lies in the fact that it would probably be hard for waves starting in a comparatively insensitive region to travel toward a highly sensitive one.

Latent Period. When a muscle is stimulated it responds only after a certain interval which is called the latent period. Highly efficient muscles tend to have short latent periods while those that are less efficient and more sluggish generally have long latent periods. It was interesting, therefore, to find that in the normal animals there is a gradient with periods running from about 0.21 second in the duodenum to about 0.26 second in the ileum. It was interesting also to find that in the injured animals this gradient was flattened. The periods in the duodenum were about 0.18 second while in the ileum they were 0.21 second; obviously the presence of a sterile abscess around the ileocecal sphincter caused the ileum to be as irritable as the duodenum ordinarily is.

Conduction. When the bowel is stimulated at any point, waves of contraction run off in both directions but the one traveling downward with the gradient generally goes farther than the one travel-

ing orad against it. In the injured animals the rate of conduction was normal in the duodenum but slow in the ileum. This slowing was most marked in the waves traveling caudad. Ordinarily, in normal animals, it is twice as easy to demonstrate waves traveling caudad as it is to show them traveling 5 cm. or more orad. We thought perhaps that the flattening of the gradient might affect this ratio but there was no pronounced difference.

Behavior of the Excised Muscle. In order to differentiate in the animals with the injured ileocecal region the results of nervous inhibition from those of actual injury to muscle, segments from various parts of the bowel were excised and their behavior studied in warm aerated Ringer's solution. So far as rhythmic contraction went they behaved normally, the rates were normal and the amplitude good. The response to stimulation was practically the same as that obtained with segments removed from normal animals. Conduction is normally much easier to demonstrate in excised segments than in the intact bowel and the rate is doubled, possibly because inhibition has been removed. This was true also in the segments from the injured rabbits, except in the case of the lower part of the ileum which when excised responded to stimulation with measurable wavelets no oftener than it did in the intact animal. Possibly there was some injury to the ileum which showed itself in this way. Furthermore, in segments from the injured animals, waves did not travel out so far as they did in the segments from normal animals.

There was so little difference between the behavior of excised segments from injured and normal animals that we were driven to the conclusion that the failure of the bowel to pass onward its contents can hardly be due to injuries sustained by the muscle but is more probably due to nervous inhibition and to flattening or reversal of gradients.

Injury to the Ileum after Degenerative Section of the Vagi. The next problem was to determine if possible which is more important: nervous inhibition or upsets in gradients. It might well be that the back-pressure observed was due purely to inhibition produced at a distance by stimuli arising in the injured region. Since Johnson has shown that most of the myenteric plexus degenerates after section of the vagi we cut these nerves and after waiting three weeks, injected turpentine into the muscle of the terminal ileum.

Before doing this we had first to see how the bowel acts after vagotomy alone. It was found that after this operation the bowel becomes very active, probably because it escapes from control. Rhythmic contractions take place incessantly and rushes appear after the slightest stimulus.

Naturally, in such an animal with the brakes off and the bowel abnormally sensitive and active, one would not expect stimuli from the ileum to inhibit or stop the rushes as well as they would in a quiet and more insensitive bowel. This seemed to us to be the best explanation for our discovery that in these animals with most of the enteric nervous system degenerated a good many rush waves were seen. Most interesting is the fact, however, that as these rushes approached the ileum their progress was slowed even more strikingly than it was in animals with normal nerves. We were particularly interested in the marked slowing of the rush waves seen in the case of one animal in which both the vagi and splanchnics had been cut and allowed to degenerate. In this animal the only long nervous paths left probably went through the postganglionic sympathetic fibers which have their nutritional centers in the celiac ganglia. The fact that in spite of this handicap the lesion in the ileum was able to stop or slow down the rushes led us to conclude that flattened gradients did have something to do with the failure of conduction.

Gradients after Vagotomy. We first studied the various gradients in animals with vagotomy alone and found little significant change from normal. After

injection of turpentine the gradients of irritability and latent period were reversed or flattened much as they were in the animals with intact nerves.

COMMENT

We know from much work on normal animals that the opening of the abdomen under salt solution and the destruction of the spinal cord distal to the fourth dorsal segment constitutes such a strong stimulus to peristalsis that after a few hours the bowel tends to empty itself with repeated rush waves. When, therefore, in the animals with the terminal ileum injured we saw so few rushes, we felt sure that in the intact animal the transportation of material from stomach to colon must have been even slower. In some it appeared to have been stopped entirely and yet the lumen of the bowel was unchanged, the rhythmic movements were active, and the muscle was efficient.

It appears then that surgeons may have to find a new term for a type of ileus which is not due to mechanical obstruction or narrowing of the lumen of the bowel. It is not "paralytic" because the muscle is active and apparently in good working order, and it is not "dynamic" in the sense that there are none of those white, ring-like contractions that sometimes obstruct the bowel in children. The explanation that we offer for it is that there is a flattening or reversal of the normal gradient of forces and an excess of nervous inhibition. Perhaps until a better term is devised we may speak of a *flat-gradient ileus.*

Peritonitis. The next question that interests the surgeon is: What happens to the bowel when peritonitis develops? Do the toxins produced by bacteria injure the muscle, and if so, how long is it before this injury is irreparable? We have not as yet done any work on the bowel of animals with peritonitis but enough has been done by Hotz and Arai to give the surgeon some idea of what happens.

Hotz, using rabbits, cut open a loop of bowel, dropped it back into the abdomen and waited a day for the development of peritonitis. Then, after anesthetizing the animal, he made a small incision in the abdominal wall, drew out a loop of bowel and recorded its contractions in a bath of salt solution. He found that the muscle of such a loop would continue to contract rhythmically even when the peritonitis was so severe that the serous coat was covered with a thick layer of pus. Rhythmic contractions ceased only after the bowel had, for several hours, been distended with gas.

Hotz concluded, therefore, that injury to the muscle in peritonitis is due, not to toxins, but to distention by gas. The gas accumulates when absorption is impaired. As Usadel showed, distention of the gut closes not only the arterioles that bring necessary blood to the muscle but also the venules of the portal system, which normally carry the gas away as fast as it is formed.[3] It can easily be seen, then, that once gaseous distention and muscular paralysis appear, they are likely to get worse and worse through the formation of a vicious circle.

Arai[8,9] produced peritonitis in cats, generally by the injection of compound solution of iodine (Lugol's solution) but sometimes also by the injection of cultures of staphylococci and colon bacilli. He used a dose that in most cases would allow the animal to recover. He then gave a barium meal and watched the behavior of the digestive tract under the roentgenoscope. At the height of the peritonitic inflammation the progress of material through the bowel was slowed everywhere but in the proximal segment of the colon; there the feces traveled rapidly. The lumen of the bowel appeared to be widened so the tone of the muscle was probably a little low. The stomach was relaxed and its movements were slow. Rhythmic segmenting movements and rushes were seldom seen.

Arai next cut the splanchnics in a number of animals and after observing that in them peristalsis was more active and the progress of material through the

gut more rapid than normal he injected iodine or bacteria and produced peritonitis as before. To his astonishment he then found that in these animals peritonitis had no effect on the rate of progress of food down the bowel, and he was driven to the conclusion that all the slowing that he had seen before must have been due to nervous inhibition. Similar observations were made by Hotz.

These experiments of Hotz and Arai led them to conclude, then, much as we have done, that in some cases of ileus even with peritonitis, the intestinal muscle is still capable of active contraction and is only held in leash by nervous inhibition. In addition, conduction down the bowel may be made difficult or impossible by a flattening or reversal of gradients.

Methods of Treatment. The surgeon, being a practical man, will immediately ask how these conclusions are to influence his methods of treatment when he is confronted as he often is with the problem of restoring downward peristalsis and saving life. What has the physiologist to suggest?

Obviously the first thing to do would be to get rid of nervous inhibition. Some try to do this by using atropine but atropine is often unreliable and ineffective. Theoretically, nicotine would be an ideal drug because it blocks the passage of nervous impulses through sympathetic ganglia but it is highly toxic and will paralyze important ganglia in the brain at the same time that it is affecting those in the abdomen.

More promising of success are the efforts that have been made of late to block the splanchnics directly with procaine injected according to the Kappis technic, or indirectly with the help of spinal anesthesia.[18] Actually the results of therapeutic efforts along this line appear to have been in many cases very satisfactory. Even in cases in which peritonitis was present and severe enough to go on and kill the patient, bowel movements were for a time secured. Much of the literature on the subject has been reviewed recently by Ochsner, Gage and Cutting. Wagner, who was perhaps

the first to induce spinal anesthesia for the cure of ileus, warned that it will not work if the patient is under the influence of morphine.

Pituitrin, especially when given in large amounts of physiologic salt solution, will stimulate peristalsis, but Judd tells us that in his experience it is as likely to do harm as good. Eserine does not appear to be reliable and its use has been given up by many who have tested it carefully.

Choline is a drug that now gives great promise of being useful to the surgeon. Much evidence has been secured by pupils of von Magnus to prove that it is a normal constituent of intestinal muscle and concerned in some way with maintaining peristalsis. We have tried it on animals and have found it to be an efficient stimulus to intestinal activity. The subject has been well reviewed by Magnus and von Klee and Grossmann. The drug must be chemically pure because it tends to break down into highly toxic substances. Merck and Kahlbaum supply it in ampules containing 600 mg. Put up in this way it will keep for several years.

For a man weighing 60 kg., the 600 mg. should be added to at least 250 c.c. of physiologic salt solution and run into a vein so slowly that the process will take at least seventeen minutes. If the patient is unusually sensitive he may complain of flushing, dyspnea, dizziness, and salivation, and the pulse will become slow. Under those circumstances the container should be lowered so that the drug will flow in more slowly. Good results were secured in many of the cases in which the procedure was tried. The surgeons in The Mayo Clinic have not yet used it enough to form any judgment as to its value.

The intravenous injection of sodium chloride alone serves as a strong stimulus to peristalsis, especially if the solution is hypertonic. F. Raine has told us of good results secured with injections of 50 c.c. of a 25 per cent solution and Coleman has advocated the use of a 3 per cent solution, 3000 c.c. of which is injected in the course

of twelve hours. McVicar tells us that in this clinic a 5 per cent solution has worked well.

According to Singer the bihydrochloride of quinine is a strong stimulant to peristalsis especially when injected into the rectum. Other drugs like sennatin, peristaltin, and isacen have been commented on favorably by German writers. A good review of the subject of intestinal stimulants will be found in an article by Vogel.

Restoration of the Normal Gradients. It will be a great day for medicine and surgery when the physiologist learns how to restore the normal steepness and direction of slope of flattened or reversed gradients. Perhaps then he will be able to restore appetite and to stop regurgitation, belching, vomiting, heartburn, nausea, and some forms of hiccup.

In animals the surest way in which to start peristaltic rushes is to induce swallowing by giving food or water; nothing else that we have tried works so well. We wonder therefore if the surgeon ought more often to use this physiologic stimulus. He might let the patient sip water or chew gum, or when a strong stimulus to peristalsis is desired, he might give the invalid a piece of meat which has been tastily prepared. Meat produces the greatest amount of psychic gastric juice; it probably has the most stimulating effect on the tone of the gastro-intestinal muscle; it is easy of digestion; its end products are promptly absorbed in the small bowel, and little is left from which gas can be formed. It is hard to see how such food could do harm, and in some cases it might well restore the steepness of the gradient of forces down the bowel and with it, normal aborad peristalsis.

Our experience with animals would incline us to caution the surgeon against distending or irritating the rectum with enemas. Especially when they are made irritating by the addition of much glucose they tend to reverse the gradient and to produce more back-pressure and reverse peristalsis. We have seen cases in which vomiting was almost certainly kept up by the use of such enemas.

The physiologist would advise the use of as little morphine as possible because in many persons it increases the tendency to reverse peristalsis. He would like to see the surgeon making more use of the barbital derivatives which in case of need can be given hypodermically. They do not upset gradients and because their action is more prolonged and more soporific than that of morphine, they give better sleep and they cut down on that nervous shock that may later lead to paralysis of the gut. To be sure when pain is severe they cannot take the place of morphine but they can keep the patient from asking for it so often.

Barbital, bromural or other similar soporifics should more often be given also on the evening before operation so that the patient will rest well in spite of strange surroundings and thoughts of the coming ordeal. Etherization appears to upset the gradients so that surgeons who make the greatest use of nitrous oxide and ethylene and regional anesthesia will probably have the least trouble with paralytic or flat-gradient ileus.[19]

We need hardly point out any longer the dangers of purgation immediately before operations. As Alvarez showed years ago this weakens the muscle and disturbs the mechanism that removes gas from the bowel. It is not yet so well known that purgation after operation is commonly unnecessary and only provocative of distress.[24] It should be used only when indicated and never as a routine measure. If the patient desires a bowel movement it can generally be secured with a harmless enema of physiologic salt solution.

Another suggestion that we would make is that the gas which so often is trapped in the splenic flexure might easily be thrown into the rectum from whence it could be voided, simply by lifting the patient's pelvis above his middle. The procedure is similar to that employed by a mother when she changes the position

of her baby so that the gas bubble in the stomach can float to the cardia and be belched. We have made some observations with the roentgen ray which show that this can be done and that it can immediately stop distress.

SUMMARY

The digestive tract is highly autonomous and the extrinsic nerves serve largely to prevent response to every stimulus. After vagotomy or splanchnicotomy peristalsis is often so active that the animal dies of inanition.

Normal aborad peristalsis appears to follow gradients of rhythmicity, irritability, latent period, metabolism, and muscular strength, running from duodenum to terminal ileum. These gradients might theoretically be reversed either by raising the irritability of the lower end of the gut or by depressing that of the upper end.

It may perhaps be stated as a law that irritation at any point in the bowel tends to slow the progress of material coming from the stomach toward it, and to hasten the progress of material moving caudad away from it. If the irritation is severe enough the result is an emptying of the digestive tract both ways from the lesion, with vomiting and diarrhea.

When, in rabbits, enough turpentine was injected into the tissues about the ileocecal sphincter to produce considerable injury, the animals suffered from diarrhea and the colon was emptied. The ileum was emptied orad and food residues were held back in the duodenum. Peristaltic rushes were few; they were hard to start, and they were slowed and stopped in the lower bowel.

The whole bowel was unusually sensitive to faradic stimuli, and in most of the experiments the normal gradient in irritability from duodenum to ileum was reversed. With the increased irritability of the bowel the latent periods were shortened, and the fact that this change was more marked in the lower ileum than in the duodenum caused the normal gradient (in latent period) to be flattened.

Segments of gut excised from the injured animals and placed in warm aerated Locke's solution behaved normally, showing that the failure of the bowel to pass onward its contents was not due to injury to the muscle.

Chemical injury to the ileocecal region in animals with vagi and splanchnics cut and much of the conducting system in the bowel degenerated still produced back-pressure in the small bowel and marked slowing of rush waves. This suggests that the flattening of gradients had something to do with the failure of conduction.

The work suggests that in treating dynamic ileus attempts should be made first, to remove nervous inhibition, perhaps by splanchnic blocking or by spinal anesthesia, and second, to restore the normal dynamic gradient by giving food, and by avoiding morphine and irritation to the lower bowel. The various methods of inducing peristalsis postoperatively are briefly reviewed.

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PHYTOBEZOAR ASSOCIATED WITH GASTRIC ULCER

ESPECIAL REFERENCE TO PERSIMMON BEZOAR WITH REPORT OF A CASE*

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THE chief purpose of this paper is to review the subject of bezoars in general and of persimmon bezoar in particular, and to discuss the association of gastric ulcer with bezoar. Furthermore, a case of persimmon bezoar associated with gastric ulcer will be reported, and abstracts of 14 additional cases taken from the literature will be given.

BEZOAR IN GENERAL

Historical. The word "bezoar," derived either from the Arabian "badzehr" or from the Persian "pad zahr," signifying counterpoison or antidote, is a term applied to masses found in the intestines and stomachs of both men and animals. Bezoars were known as early as the twelfth century B.C. and were highly prized and sought after as remedies against poisons and pestilential diseases. Worn as charms they supposedly would protect one from all evil. Even up to the eighteenth century A.D., bezoars enjoyed almost universal confidence as remedies, and both the tincture and pulvis bezoardicus occupied prominent positions in the materia medica even if neither contained a trace of bezoar. They were more precious than gold and flagrant counterfeits were made. In order to save the public from itself Lonicer (1582)[4] made known some simple tests whereby fraud could be detected easily and effectively: (1) if a hot needle were inserted into a true bezoar, there would be no smoke; (2) if a poisoned man or beast were given a powder prepared from a bezoar and should survive, the bezoar was genuine; (3) if a sample of a true bezoar were mixed with water or saliva, it would color cloth. Bezoars of olden times probably were derived solely from animal sources; for instance, from sheep and goats. Fine distinctions were made between oriental and occidental bezoars. The former contained cholestrin, bile pigments and bile salts and on combustion diffused an aromatic odor and left no residue. The latter contained calcium and magnesium and on incineration left a residue.

Composition. Today, bezoars which are found in human beings are, from the medical standpoint, divided according to the predominating material of which they are composed: trichobezoar (pilobezoar, hair-ball), trichophytobezoar, concretion, and phytobezoar (hortobezoar).

Of all types, hair-ball is the most common,[4,18] Young women, otherwise sound in mind and body, occasionally become addicted to the habit of chewing and biting off the ends of their hair and trichobezoars are formed. As the name implies, both hair and plant matter form the second group.

Concretions are bezoars of the more solid sort. With few exceptions, they are composed exclusively of shellac.[7,9,25] These bezoars usually are found in painters and employees in furniture factories who drink furniture polish (a strong alcoholic solution of shellac) as a stimulating beverage. Subsequent ingestion of water precipitates the resins which accumulate in the stomach. Repetition of this process accounts for enormous masses, weighing up to 2000 gm., which have been found in the human stomach. Two cases have been reported

in which the material of the concretions was not shellac. Kummant reported the case of a woman, aged thirty-seven years, who, twenty-three days after ingestion of a contrast meal of bismuth for roentgenographic study, underwent resection of the stomach for ulcer. A bezoar of pure bismuth carbonate was found and removed. When dried it weighed 40 gm. Woelffler and Lieblein cited Hamdi's case in which a Turk, aged fifty years, who had taken large doses of salol for cystitis, came to necropsy. In his stomach was found a glistening, crystallized bezoar of salol about 5 by 3 cm.

Phytobezoars are composed of vegetable material: stems, skins, fibers, or seeds. Other debris becomes included: starch granules, fats, fatty acid crystals, muscle fibers, elastic tissue and epithelium. Retention of plant matter by the human stomach, other than in cases of pyloric obstruction, is rare.

In the first recorded case of phytobezoar, that of Bucknill, which was reported by Quain in 1854, the mass was composed of string and cocoanut fiber. The patient was an epileptic man of twenty-two years, who was accustomed to eating gravel, dirt, rags and other debris, of which he ridded himself by diarrhea. Within twenty-four hours following an acute pain, and showing symptoms of peritonitis, he went to rapid dissolution. Necropsy revealed a perforation larger than a shilling on the lesser curvature of an otherwise healthy stomach, the lumen of which bulged with the 4 lb. mass the composition of which has been described. Cocoanut fiber, in addition to wood, figures in Hichens and Odgers' case. A woman, aged twenty-four years, complaining of pain in the stomach and of vomiting, and with a mobile epigastric tumor, was sent home with a belt and the diagnosis of floating liver or kidney. Subsequently she became very ill and passed two masses resembling pieces of door mat. A more complete history was obtained and abdominal exploration was advised. A cast of the same mat-like

material weighing about 525 gm. and containing much fat, was removed from a structurally healthy stomach.

Occasionally unorganized plant material is found. Bryan, at gastrotomy on a Hindu, aged fifty-five years, removed, with the aid of sponge and spoon, a quantity of cellulose and other bits of undigested food. Hamdi reported 3 cases in men ranging in age from thirty to thirty-eight years, who under the stress of war and of flight from captivity, foraged in the open fields for periods from at least two to four weeks. Each developed loss of appetite, with corresponding loss in weight, along with postprandial epigastric pain, vomiting, and tumor formation. A bezoar of vegetable material was obtained from each one. The diets had included varying quantities of mallow roots, wild beets, couchgrass, parsley-like plants, and chenopodium roots, usually eaten raw. By rolling and coiling such plants in the hands, then keeping them for two days at incubator temperature in a digesting fluid of hydrochloric acid 0.1, pepsin 0.2, and water 100, Hamdi obtained material that exactly resembled that of the bezoars derived from the stomachs of these three men. In spite of the fact that much peeled rhubarb, black radish, kohlrabi, cragopon, acanthus and lettuce are eaten raw in his locality, to Hamdi's knowledge, such bezoars were never before observed.

Judging from the history of Schreiber's case, "schwarzwurzel" was implicated. This is a variety of salsify, which when cooked in butter, is eaten as a home remedy. He reported the case of a woman, aged forty-five years, who gave him the impression of being extremely neurotic, but presented, also, a movable tumor in the right side of the abdomen. A diagnosis of movable degenerating kidney was made. Enemas caused the mass to disappear for the time being; then it reappeared, but on the opposite side of the abdomen. Von Eiselberg then operated on her, with his diagnosis of carcinoma or movable spleen as a basis for the operation. A bezoar of

250 gm., with a circumference of 20 cm., was removed from the stomach. Several concretions were found at necropsy by Langenbuch. A large one from the stomach and a smaller one from 3 cm. below, in the intestine, were obtained from a subject who during life drank much "nussblätter tea." In the United States the more familiar materials found in phytobezoars are derived from the pumpkin, raisin, prune, celery and persimmon.

Etiology. The etiology of bezoars depends on no one particular factor. Positive factors seem to be the rapid satisfaction of a ravenous appetite by material suitably plastic for the muscular constrictions of the stomach to knead and mold it into a ball. There is reason to believe that they are formed at one time; layers of accretion are not found on section. If the formation of phytobezoars is dependent on a rich vegetable diet alone, the majority of vegetarians enjoy undeserved freedom from them.

Diagnosis and Treatment. Clinically phytobezoars are easily overlooked. The history and the roentgenologic study give the only reliable clues. The presence of a bezoar in an otherwise healthy subject has led to diagnoses ranging from floating kidney and movable spleen to polyp, adenoma and carcinoma of the stomach. Roentgenologically there should be no doubt as to the nature of the tumor. With a barium meal, the stream divides or pours over an object in the antral part of the stomach. The shadow of this object looks like an empty space or an air bubble; it is freely movable, and can be made to disappear and to reappear in various quarters of the stomach without pulling the wall inward. After the meal has passed into the intestine a barium-streaked object remains. Such bezoars float in a barium meal and sink as the barium separates out. Treatment usually is surgical.

BEZOAR AND ULCER

The association of gastric ulcer with foreign bodies of the stomach has been reported previously. Such ulcers also may occur from trauma to a stomach which has herniated through a defect in the diaphragm. That these ulcers are directly due to trauma has been proved beyond any reasonable doubt by the fact that they disappear following removal of the irritation. For example, in ulcer of the stomach associated with diaphragmatic hernia, replacement of the stomach and repair of the hernia, in the majority of instances, is followed by disappearance of the lesion. In 1926 Waller reported a case of a large hair-ball in the stomach associated with a large chronic ulcer of the posterior wall. At fluoroscopic examination the lesion was suspected of being malignant. However, the ulcer completely healed following removal of the hair-ball. In the case to be reported, the lesion had a punched-out appearance with considerable induration, and this, together with the fact that the patient had had symptoms for three or four years before he had eaten the persimmons made it probable that the ulcer had existed before the formation of the persimmon ball and was, therefore, not associated with it. Because of this it appeared safer to resect the stomach, including the lesion.

PERSIMMON BEZOAR

"Persimmon" is the American Indian[13] name of a native tree, the fruit of which first was described and praised by early explorers. De Soto (1539) and Jan de Laet (1558) mentioned it.[6] John Smith, in an account of the resources of the New World in the first year of the seventeenth century devoted a long description to it. Often called a plum, its fruit is a true berry, oblate to oblong in shape, with a diameter up to 5 cm. Its translucent flesh, ranging in color from yellow through orange to a dark red, houses as many as eight flat seeds.

Producers adjacent to large communities now have built up a considerable demand for the fruit, which, according to its Greek name, "Diospyros" (Jove's fruit), is fit for the gods. It is used in localities where

it is common (Fig. 1), in pone, ice cream, taffy and fudge, and in the preparation of home-made beverages. Evaporated in

be the manifestations. Loss of weight and hematemesis are rare. Gastric ulcer may be associated. Occasionally symptoms may
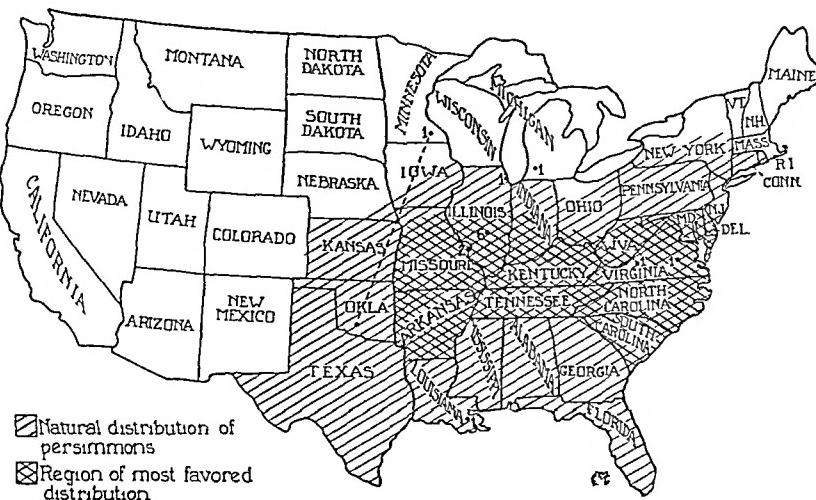
FIG. 1. Approximate distribution of the persimmon in the United States with source of cases of persimmon bezoar.

mass, it forms a "leather," which, when diced, is used on cookies and in pastries instead of citron or raisins.

Fresh, ripe persimmons, eaten raw, seem especially to lend themselves to the formation of bezoars, apparently because even though their content of fiber is relatively low (4.3 per cent), their sticky juice and pulp contain 14.1 per cent gums and pectin. The quantity of persimmons eaten apparently has little to do with the formation of persimmon bezoars. There has been no question of lack of tone of the musculature of the stomach in patients in whom bezoars have been found; on the contrary, good, healthy muscle action appears to be one of the requirements for the formation of bezoars. Proper mastication, admixture with saliva and the custom of eating raw fruits with sugar and cream are mentioned as preventives of the formation of bezoars.

Symptoms of persimmon tumors usually take the form of an acute gastrointestinal upset within a few hours or days after the ingestion of the fruit. Nausea, vomiting, pain and diarrhea are present in varying degrees. There may be some fever. In the less severe forms, only a sense of epigastric heaviness or fullness, along with alternate constipation or diarrhea, may

suggest disease of the gall bladder, angina pectoris, duodenal ulcer or carcinoma.

Although the standard treatment is surgical, simpler methods than surgical procedures have been successful in sporadic cases of persimmon tumor. Outten quoted King's account of a case in which, while the patient was awaiting operation, massage of the stomach was instituted, and after two weeks, the palpable tumor disappeared with the passing of seeds. Another case was cited by Outten, in which a male Negro gave a history of eating persimmons, and presented a circumscribed epigastric mass and suffered violent vomiting and had a fever of 104°F. The mass disappeared and seeds were passed within forty-eight hours under free catharsis. Even though digestants in the concentration found in the stomach have no effect on bezoars, Mills and Simpson, in a case in which there was achylia, administered dilute hydrochloric acid. In a few days hard dark masses of fruit skins and stems were passed; later roentgenologic study indicated that the mass was gone from the stomach. It is assumed that the acid stimulated proteolytic action by which the cementum of the vegetable detritus was dissolved.

Persimmon bezoars may be roughly spherical, cylindrical or conical in shape. In one instance, the bezoar assumed the shape of a half brick. They usually are about 5 by 8 cm. and one or more may be present. The surface shows the effect of attrition and may be marked with a velvety pattern by the mucous membrane of the stomach. Color may vary from dark brown, black, or greenish-yellow on the surface to a lighter shade within. At times, the outer crust may be carbonized or infiltrated with salts, and when seeds are present they project from the surface, making it very irregular in contour. A thin section microscopically may look like cork. Rolled and curled fruit skins may be recognized. A putrid odor, the sour odor of stomach contents, or an odor of fermenting fruit is given off. In a case reported by Peple the patient vomited pink fluid with a decided odor of fruit.

In the series to be reported, including our own case, 13 patients were males, 2, females. The age incidence was as follows: 1 patient was twenty years of age; 1 was in the age group from twenty-one to thirty years; 4 were in the group from thirty to forty years; 2 were in the group from forty-one to fifty years, and 7 were in the group from fifty-one to sixty years.

The most constant symptoms of the digestive upset were epigastric pain, nausea, vomiting and diarrhea. Time elapsing from the ingestion of the raw fruit to the recovery of the bezoar ranges from seven days to a little more than two years. Gastric analysis revealed all grades of acidity and anacidity from hyperchlorhydria to achlorhydria. Palpable tumor was present 5 times, was questionably present once, and 2 patients sensed a lump rather than felt it. Persimmon bezoar was associated with ulcer four times. Roentgenologic study disclosed a mass in 9 cases and the interpretation was correct in 4. Operations in the 15 cases included 15 gastrotomies, 2 gastroenterostomies, 1 enterostomy of the small bowel distal to gastroenterostomy, and 1 sleeve resection

of the stomach; in 1 case gastrotomy was not performed and in 1 case it was performed twice. The gastroenterostomies were done for ulcer, resection of ulcer was done in 2 cases, and in the remaining 2 cases of the 4 with ulcer nothing was done for the ulcer. There were 12 recoveries, 2 immediate deaths from peritonitis, and 1 patient died three months later from tuberculosis which terminated postoperative pneumonia.

REPORT OF A CASE

A man, aged twenty-four, presented himself at The Mayo Clinic July 23, 1928 complaining of indigestion which had existed for a year and the chief symptom of which was "gas on the stomach." He had ignored this symptom until a month previously, when a dull pain had appeared along the left costal margin when the stomach was empty. The discomfort occasionally awakened him at night and always was relieved by eating. A week before he came to the clinic, a diagnosis of gastric ulcer was made by roentgen ray.

The patient was well developed and well nourished. One devitalized tooth, and enlarged and infected tonsils were present. There was more than moderate midepigastric tenderness. Urine analysis gave negative results. There was moderate secondary anemia; hemoglobin was 66 per cent and the color index was 0.8+. Results of other blood examinations were negative. There was moderate prostatitis, and Staphylococcus albus was cultured from the prostatic fluid. Gastric analysis performed on 50 c.c. of gastric content revealed total acidity equivalent to 66, and free hydrochloric acid equivalent to 42 c.c. of one-tenth normal sodium hydroxide. The roentgenogram of the chest was negative; that of the stomach suggested a perforating ulcer on the lesser curvature of the stomach above the angle and showed a central filling defect high in the stomach, apparently a benign tumor.

Abdominal exploration was performed by one of us (Balfour) July 28, 1928. A subacute gastric ulcer, with a crater 1.2 c.c. in diameter, was present on the posterior wall, at the angle. Within the stomach an unattached tumor about 7.5 cm. in diameter was palpable. A segmental resection of the body of the stomach, including the ulcer and intragastric

tumor, was done (Figs. 2 and 3). The tumor proved to be a bezoar, a soft, putty-like, bluish-black mass, weighing 60 gm. It was

FIG. 2. Wax replica of the persimmon bezoar.

nearly spherical, and its surface showed the effects of attrition. It crumbled easily, and there was exposed a brown, rather homogeneous interior, from which arose the not unpleasant effluvium of fermenting fruits. Seeds or pits were not present; certain bits were recognized as fruit skins.

On further questioning the patient recalled certain seemingly unimportant incidents. The duration of gastric distress probably was four years rather than one year. A year previously, while out hunting, he and his companions had come to a persimmon grove; all were very hungry and all had eaten freely. The patient devoured, according to his estimate, a quart of the fruit; he had never before, in all his life, eaten more than a cupful. A few days later he was ill, with nausea and a heavy feeling in the epigastrium. Recovery following operation was uneventful.

CASES FROM THE LITERATURE

Outten, in 1894, reported the case of a man, aged fifty-seven years, who had eaten persimmons and bread early in 1891. Several hours later he had experienced nausea and vomiting and had been sick ten days. In December, 1891 he had been hospitalized for nausea, and tumor of the stomach had been found. Two months later, in another hospital

a hard nodular mobile tumor had been found. The diagnosis was floating spleen. Two gastrotomies were done for two bezoars

FIG. 3. Resected portion of stomach showing perforating ulcer.

weighing together 617.6 gm. Pneumonia developed on the eighth postoperative day and the patient died three months later of tuberculosis. Ten to twelve months had elapsed from the time the persimmons were eaten until the tumor was discovered.

Peple, in 1922, had as a patient a man aged fifty-two years, with epigastric distress, nausea, and a lump in the stomach. He complained of vomiting and of tasting fruit. Forty days before he had eaten persimmons, seeds and all. December 16, 1922, a palpable movable mass was discovered. Diagnosis by roentgen ray was of polyp or foreign body. Gastrotomy was performed and a bezoar, 8.75 by 7.5 cm., full of seeds and fibers, was removed. Recovery was uneventful.

Hart, in 1923, reported the case of a man, aged fifty-four years, who had eaten heartily of persimmons October 10, 1918. Six hours later he had suffered from vomiting, diarrhea, paroxysms of great pain and retching. A filling defect was found by roentgen ray in the pars media of the stomach. The diagnosis was pyloric obstruction. At gastrotomy, February 13, 1919, a foreign body composed of persimmon seeds and skins was removed. The man died from peritonitis. The duration of time from the eating of persimmons until operation was four months.

Another of Hart's patients was a man aged thirty-nine years. December 5, 1922 he ate 700 gm. of persimmons and some cranberry sauce. Four hours later he had severe epigastric pain and nausea, but no vomiting. The pain lasted for three to four days; then there was some vomiting of mucus and sour fluid. By roentgen ray a mass was observed. The

diagnosis was foreign body, probably persimmon tumor. Gastrotomy was performed January 13, 1923. A bezoar of persimmon seeds, skins, and other food debris, 7.5 cm. long, 5 cm. wide, and 3.75 cm. thick was found in the cardiac portion of the stomach. Recovery was uneventful. The time which elapsed between the eating of persimmons and discovery of the tumor was five weeks.

Hart also reported a case in a man aged forty years. He gave a history of occasional indigestion. He had eaten a large quantity of persimmons November 16, 1921. Soon he had been in considerable pain and he had induced vomiting and purging. This had given him relief. Diagnosis was not made preoperatively. At operation, November 23, a bezoar of persimmon seeds and skins, about 5 by 8 cm., was removed from the stomach. Recovery was uneventful. Seven days had elapsed in this case between the eating of persimmons and operation.

A man aged fifty-three years, a patient of Hart, gave no history of indigestion. November 3, 1919 he had eaten an unripe persimmon and in half an hour he had eaten two apples. Soon he had had epigastric pain, nausea and vomiting, and then severe diarrhea had begun which had lasted two weeks. He felt as if he had a ball in the stomach which should come out. He became constipated and had pain when his stomach was empty. The stools were black and the vomitus acid. Diagnosis was not made preoperatively. Gastrotomy was done January 28, 1920, and a bezoar of persimmon seeds and skins about 5 by 8 cm. was removed. Recovery was uneventful. He had some distress after eating and he was constipated. Eighty-one days had elapsed between the eating of persimmons and operation.

One of Hart's patients, a man aged thirty-five years, complained of stomach trouble which was exemplified by epigastric pain and eructation of sour material for eight years. Foods which were not acid relieved the pain. In November, 1921 he had eaten heartily of persimmons. In the night he had been awakened by severe epigastric pain and nausea, accompanied by vomiting of mucus. Then, on lying down, he had felt a lump in his stomach. He had vomited a considerable amount of blood once. Gastric analysis in terms of cubic centimeters of one-tenth normal sodium hydroxide was total acidity 74. Occult blood was graded 4. The clinical diagnosis was gastric ulcer and the diagnosis by roentgen ray, crater ulcer

in the lesser curvature and mass in the pars cardica of the stomach. A bezoar of persimmon seeds and skins and other food debris, about 7.5 by 7.5 cm., was removed at operation. Recovery was uneventful. The period from the time the persimmons were eaten until operation was nine months.

Another man who came under Hart's observation was aged fifty-three years. He gave a history of many years of epigastric pain and distress coming on three to four hours after eating. The taking of soda and food had relieved him until one year before the present trouble. In November, 1920 he had eaten heartily of persimmons; he never before had eaten any of them. He had felt sick all over; purging had not relieved the pain, which had lasted four to five days and then had subsided. Attacks had continued until May 8, 1922, when he entered a hospital. A palpable mass was not discovered. There was hyperacidity. Roentgen-ray diagnosis was ulcer on the lesser curvature. A special diet for four to five weeks did not give relief and a malignant lesion was suspected. At operation, June 5, 1922, a benign ulcer was resected. Gastroenterostomy was done and a mass was not noted in the stomach. Recovery was uneventful and he was dismissed June 18, 1922. February 3, 1923, he had sudden, severe, epigastric pain that in three hours shifted to the umbilicus. The diagnosis was intestinal obstruction. At operation, February 5, 1923, a large foreign body was removed from the small bowel a few centimeters distal to the gastroenterostomy. The mass was cylindrical, 7.5 cm. long and 5 cm. wide. It was composed of persimmon seeds and yellow homogeneous matter. Recovery was uneventful. Three series of examinations by roentgen ray had not revealed the bezoar. Two years and two and a half months had elapsed from the eating of persimmons until operation.

Upson, in 1925, reported the case of a man aged forty-two years. He gave a history of indigestion of four to five years' duration exemplified by an inconstant sensation of heaviness after eating. For a few months he had had gnawing, burning pain three to four hours after eating. Gas in the stomach and eructation of sour material was relieved by food. The roentgen ray disclosed a free tumor in the stomach. At operation an oval bezoar, 5 cm. in diameter, composed of slices of fruit with persimmon seeds in the center, was removed. Recovery was uneventful.

Porter and McKinney reported, in 1926, the case of a man aged thirty-five years with a history of thirteen months of epigastric distress. In November, 1924 he had eaten freely of persimmons. A few hours later epigastric pain, nausea and vomiting occurred. Then for one week, he had an acute, severe, gastrointestinal upset with nausea, vomiting, diarrhea and epigastric pain. The diagnosis had been ptomaine poisoning. After the acute attack had subsided, he had experienced boring, epigastric pain one-half to two hours after eating. This had been relieved by taking food and soda. Examination revealed an emaciated patient with moderate anemia, with a mass about 5 by 8 cm. in the epigastrium. Gastric acidity, in terms of cubic centimeters of one-tenth normal sodium hydroxide was total acidity, 80 to 50 and free hydrochloric acid, 50 to 36. A foreign body in the stomach was disclosed by roentgen ray. The tentative diagnosis was persimmon ball. At operation, December 24, 1925, a bezoar weighing 59 gm. was delivered. Recovery was uneventful. The duration from the time of eating persimmons until the discovery of the tumor was thirteen months.

Larimore, in 1927, reported the case of a man aged twenty years. He had eaten persimmons one year previously. Constant epigastric distress had followed. He had had pain one to two hours after eating and at night. Occasionally the pain had been worse before eating and food had relieved it. There had been some nausea but no vomiting. Persistent belching had been present but there was no regurgitation. The bowels had been regular. There was no palpable mass. Gastric acidity in terms of cubic centimeters of one-tenth normal sodium hydroxide was total acidity, 56 to 57 and free hydrochloric acid, 27 to 42. A displaceable mass, about 5 by 8 cm., was revealed by roentgen ray. At operation, a bezoar of persimmon residue was obtained. Recovery was uneventful. One year had elapsed in this case between the eating of persimmons and the discovery of a tumor.

David, in 1928, had as a patient a woman aged fifty-nine years, with a history of constant epigastric pain for one year, which was worse at night. The pain was not related to the taking of food. She obtained relief by vomiting watery, brown fluid. Eighteen months before, while on a visit in central Illinois, she had eaten persimmons. From then on she had had trouble. There had been much loss of weight.

The epigastrium was rigid with a questionably palpable tumor. Gastric acidity in terms of cubic centimeters of one-tenth normal sodium hydroxide was total acidity, 24 to 36 and free hydrochloric acid, 0. Roentgen ray revealed a penetrating lesion of the lesser curvature. The diagnosis was penetrating ulcer, probably malignant. At operation, October 4, 1925, a bezoar, 12.5 cm. long, 10 cm. wide and 7.5 cm. in thickness, composed of semisolid debris and persimmon seeds was recovered. There was a large, penetrating ulcer. Anterior gastroenterostomy with side-to-side anastomosis of the jejunum was made. Postoperatively the patient continued to vomit and refused food. October 25 jejunostomy was made. Death occurred five days later. Eighteen months elapsed from the time the persimmons were eaten to the time of the operation.

Maes, in 1928, reported the case of a man aged fifty-seven years. Following ingestion of persimmons and water he had had acute, cramp-like, abdominal pain. There had been no nausea or vomiting. Attacks of pain had occurred regularly at intervals of one to three weeks for the relief of which morphine was required. A free, mobile, upper abdominal mass was present. Diagnosis after examination by roentgen ray was probably phytobezoar. At operation a bezoar about 7.5 cm. in diameter, and weighing 386 gm. was removed. Recovery was uneventful.

Garrett, in 1928, reported the case of a man, aged forty-two years, who complained of a feeling of distress in the epigastrium, worse about one hour after eating. He felt as though there was a "lump" in his stomach, and that something seemed to block the passage of food at times. Roentgenologic examination of the stomach revealed an area of decreased density which could be moved freely to any part of the stomach. The patient stated that he had eaten freely of persimmons while hunting eight months before. Following a diagnosis of phytobezoar diospyri virginianae, gastrotomy was performed and a large, black cylindrical mass, 9.5 by 4.2 cm. and weighing 68 gm., was removed. The patient's convalescence was uneventful.

SUMMARY

A résumé of the bezoars is presented.

A case of persimmon bezoar associated with gastric ulcer is reported.

Fourteen similar cases from the literature are briefly reviewed.

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AN OPERATION FOR THE INDUCTION OF
OSSEOUS FUSION IN THE ANKLE JOINT*

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AS the entire weight of the body is transmitted through the ankle joint, mechanical or organic defects frequently induce permanent and serious disability. The rocking motion of the ankle joint should be conserved, when possible, but when there is only slight motion accompanied by persistent pain, a stiff ankle is preferable. In order to restore to approximately normal function an extremity so affected, the ankle joint must be eradicated and an arthrodesis or osseous fusion induced. This results in some inconvenience in walking on uneven surfaces; however, it is surprising how much compensation of function may be developed by increased motion in the subastragalar, midtarsal, and the tarsometatarsal joints.

The procedure is indicated in tuberculosis of the ankle in adults and following fractures or pyogenic infections which have eroded the articulation and caused an incongruity of the joint surfaces.

Tuberculosis of the ankle in adults may be arrested in a small percentage of cases by conservative measures, but comparatively few individuals can afford prolonged treatment, especially when the result of such measures is more or less uncertain. After a considerable period of treatment, adults frequently submit to amputation, whereas, if fusion of the articular surfaces could be induced, a useful limb will almost invariably be secured. In children there is a difference of opinino as to the advisability of operative fusion of any joint, but recent favorable reports of such measures in other joints suggest the possibility of attaining similar results in the ankle.

Pyogenic infections erode the articulation; and cause adhesions in the ankle joint by the organization of exudates and the formation of scar tissue. Fractures in close proximity to or involving the ankle joint may induce irreparable mechanical defects of the joint surfaces. Traumatic arthritis may cause similar reactions. Such lesions do not always cause persistent disability and the disability may be compatible with excellent function; however, when it is such as to impair seriously the efficiency of the individual, the fusion operation is indicated.

The routine operation for the purpose of inducing osseous fusion of the ankle joint consists of denuding the articulation of cartilage and approximating the osseous surfaces. The attempt is often followed by failure of the bones to unite, since it is difficult to approximate the bones accurately. Also, if the process is tuberculous, the latent infection may be relighted or a tuberculous focus elsewhere may be induced. Osseous fusion of all tuberculous joints should be accomplished, when possible, by surgical procedures which are extra-articular. In the ankle joint the extra-articular method is preferable, not only in tuberculosis, but also when there is incongruity from any cause. The procedure which will be described was suggested by 2 cases in which accidental and unintentional fusion of the ankle joint followed the author's operation for drop-foot.

TECHNIQUE

The operative technique is as follows: A longitudinal incision is made, beginning about 4 inches above the ankle joint and 1 inch internal to the fibula and continued

downward over the lateral aspect of the ankle joint, terminating on a level with the superior surface of the external cuneiform

FIG. 1. Anterior lateral incision showing exposure of anterior aspect of ankle joint with osteoperiosteal graft in contact with denuded surfaces of tibia and astragalus.

bone. The superficial and deep structures are incised and the lower third of the tibia and the ankle joint are exposed. The superior surface of the neck of the astragalus is denuded. An osteoperiosteal graft about 4 inches in length is removed from the lower third of the tibia, thus denuding the lower third of the tibia. The graft, together with small bone shavings from the anterior aspect of the tibia is placed over the ankle joint in close proximity to the denuded surface of the lower extremity of the tibia and the denuded surface on the neck of the astragalus. A second skin incision 3 inches in length is then made over the posterior aspect of the ankle joint to the lateral aspect and parallel with the tendo achillis. Dissection is made between the tendo achillis and posterior capsule of the ankle joint, care being taken to retract the extensor hallucis tendon inward. The posterior capsule of the joint is incised transversely. The posterior extremity of the astragalus and the cartilage from the posterior portion of the ankle joint are removed. The posterior aspect of the tibia just above the ankle joint is denuded. A mass of bone is removed from the superior surface of the os calcis and placed in con-

tact with the denuded posterior surface of the tibia and denuded surface of the os calcis. An osteoperiosteal graft may also be
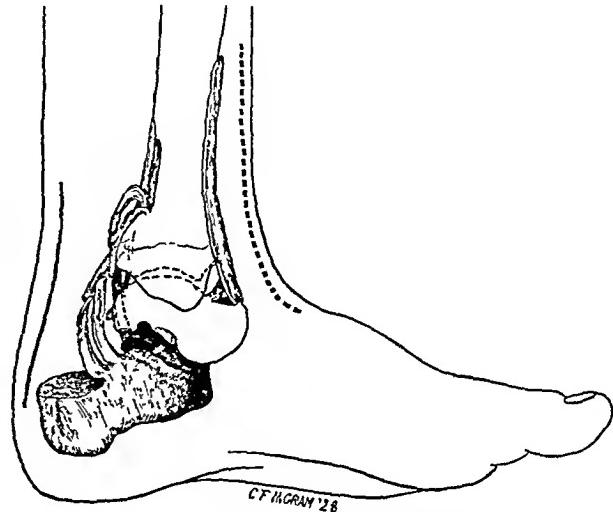
FIG. 1A. Schematic drawing showing location of incisions and technique of application of graft.

placed on the posterior aspect. Both wounds are then closed and a plaster cast, extending from the toes to just below the knee, is applied, holding the foot in slight equinus position.

FIG. 2. Posterior incision showing exposure of back of ankle joint and bone chips obtained from posterior surface of tibia and os calcis.

The equinus position greatly facilitates walking and, to some degree, compensates for the lost rocking motion of the ankle joint. The graft may be taken from the opposite limb when the quality of the bone on the affected side is defective.

The cast should be worn for at least three months, after which a brace is applied. A plaster model of the foot and leg

FIG. 3. Roentgenogram of Case 1, showing destruction in astragaloscaphoid and calcaneocuboid joints.

is made from which a leather corset is constructed and reinforced with steel bars, so that complete immobilization is secured. In this apparatus weight is permitted, but the brace must be worn until fusion is solid. Fusion, after any operation on the ankle joint, results only after an elapse of considerable time. This is probably due to the fact that there is no natural circulation between the articular surfaces, as between the two fragments of a fractured bone.

CASE REPORTS

CASE I. Tuberculosis of the right ankle. A woman, aged sixty years, was first examined August 31, 1926. Nine years before she had injured the ankle by falling. The joint remained painful on use and two years previously a cast had been applied and worn for a short time. The ankle was moderately swollen and tender on pressure over the head of the astragalus, scaphoid and cuboid bones. The entire foot and ankle were held rigid, but there was no hyperemia or fluctuating. The roentgenogram showed destruction and erosion of the calcaneocuboid and astragaloscaphoid joints. The cuboid bone was almost completely destroyed and the bones of the entire foot and leg were osteoporotic. The Wassermann test was negative and the general examination was essentially negative.

A molded leather brace was applied and walking advised with gradually increased weight-bearing. Heliotherapy was also pre-

FIG. 4. Roentgenogram of Case 1, eighteen months after arthrodesis, showing solid fusion of the ankle and midtarsal joints.

scribed, but the symptoms increased in severity. April 24, 1927, an extra-articular fusion of the joint was performed, including the midtarsal joints. From tissue removed from the joint at the time of the operation tuberculosis was diagnosed. The foot was immobilized in a cast for three months, after which time walking was permitted in a brace. The result was excellent. A year and a half after the operation the arthrodesis was completely solid, the foot in good weight-bearing position, and the patient was able to walk without pain.

CASE II. Tuberculosis of the left ankle. A woman, aged thirty-five years, was examined April 10, 1926. At the age of ten years the patient sprained the left ankle. Pain and swelling persisted and gradually increased. An abscess formed which ruptured spontaneously and there was a daily elevation of temperature for a period of over three years. The symptoms then subsided and remained quiescent until the patient was twenty-seven years old. At that time persistent pain followed a mild injury and the foot was immobilized in a cast for six months. Since that time the pain had gradually increased in severity and for three months, preceding the examination, walking was possible only with crutches. The roentgenogram revealed an old destructive arthritis of the left ankle joint. The articular surfaces of the tibia and astragalus

were eroded, the body of the astragalus was flattened and all bones of the foot showed osteoporosis. The Wassermann test was nega-

healed promptly and on January 12, 1928, the cast was removed and an ankle brace fitted. Fusion occurred rapidly; by October, 1928, the
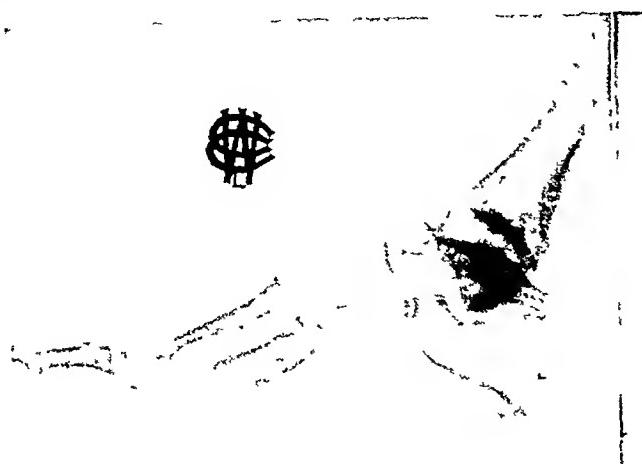
FIG. 5. Roentgenogram of Case II, showing erosion of ankle joint and flattening of astragalus.

FIG. 6. Roentgenogram of Case II, after extra-articular fusion, showing solid union.

tive. On May 6, 1926, an intra-articular fusion of the joint was performed, denuding the articular surfaces of the joint. The wounds healed, but throughout the subsequent period of eighteen months pain persisted and bony fusion did not occur. A second operation by the

arthrodesis was solid, the foot was in good functional position and the pain had been entirely relieved.

CASE III.   Infectious arthritis, left ankle. A man, aged forty-two years, examined May 11,

FIG. 7. Roentgenogram of Case III, after extra-articular fusion. Note proliferative changes in bones and calcaneal spur.

FIG. 8. Roentgenogram of Case IV, after arthrodesis. Note density of grafts in comparison with atrophic bones and beginning callous production.

extra-articular method was advised and performed October 24, 1927. The tibioastragalar joint was refreshed, the subastragalar and mid-tarsal joints denuded of cartilage and an osteo-periosteal graft from the tibia placed across the joint anteriorly and chips of bone from the os calcis and tibia placed posteriorly. The wounds

1927, was complaining of swelling of the left ankle. He had bruised the ankle June 12, 1925, when his foot slipped off the clutch pedal of an automobile. Two incisions for drainage had been made, but no pus was formed. A month after the accident a cast was applied which he wore for five months. The swelling persisted;

the joint was stiff and painful on weight-bearing. The ankle was enlarged, the muscles of the calf were atrophied and there was tenderness on pressure over the internal malleolus. No motion was demonstrable in the joint. The foot was in good weight-bearing alignment, but the patient walked with a cane.

The roentgenogram showed destruction of the articular surfaces of the left ankle with apparent ankylosis. The tarsal bones showed osteoporosis and there was a spur on the os calcis. There was a previous history of acute gonorrheal urethritis. The Wassermann test was negative.

A fusion operation was performed on February 2, 1928, following which a cast was applied and worn until May, 1928, and subsequent to that an ankle brace. The result is excellent. When last seen the arthrodesis was practically solid.

CASE IV.   Tuberculosis of the left ankle. A woman, aged thirty years, was first examined March 7, 1928. The joint had been painful at varying intervals since she had sprained it in May, 1927. For four months the pain had become insidiously and progressively worse and for two months she had been unable to bear her weight on the left foot. The joint was swollen, the local heat was increased, there was tenderness over the anterior surfaces of the joint and over the internal malleolus. Passive and active motions were limited. The roentgenogram demonstrated a narrowing of the joint space, an erosion of the articular surfaces and osteoporosis of the bones. The Wassermann test was negative. An extra-articular fusion operation was performed on March 8, 1928, using two osteoperiosteal grafts from the opposite tibia, one of which was placed anteriorly and one posteriorly to the joint. When the joint was exposed at the time of the operation, the cap-

sule was found distended, the synovial membrane congested and the fluid was seropurulent in character. Microscopical examination of a specimen of tissue from the synovial membrane was not definitely conclusive of tuberculosis, but was highly suggestive. Following the operation the wounds reopened and discharged a thin serous fluid. The sinuses healed sufficiently after eight months to allow the application of an ankle brace and to permit the patient to begin weight-bearing. The arthrodesis, at the present time, is not completely solid, but is apparently progressing rapidly.

DISCUSSION

The results of this operation have been most satisfactory. In tuberculous cases a period of six months is required before osseous fusion is complete. The most favorable time to induce fusion in tuberculous joints is in the early stage or in the residual stage, after the disease has subsided. When the process is active, with extensive destructive changes, osseous reaction is at a low ebb and there is grave danger of exaggerating the already active process or of causing secondary infection.

It is possible that the anterior incision and the osteoperiosteal graft may be omitted and that osseous fusion may be induced by employing only the posterior route. However, if an osseous bridge on both aspects can be induced, the result is more certain. In those in which there has been no evidence of tuberculosis, there is no reason why the joint also may not be denuded, as an additional security, but this is rarely necessary.

THE QUARANTINE IN ABDOMINAL SURGERY*

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THE quarantine in abdominal surgery implies the setting apart of a segment of the abdominal cavity so that peritoneal absorption and subsequent morbidity may be limited. The peritoneal cavity is a closed lymph sac which has facilities for absorbing large quantities of fluid very rapidly. A virulent infection generally distributed over the peritoneum is absorbed into the circulation with amazing rapidity. Hence, the ominous significance of the term "general peritonitis."

Most of the preparation of the food which sustains life is done within the gastrointestinal tube. Great activity and freedom of motion is necessary for the proper functioning of the organs constituting this tube. The free movement of these various organs or parts of this canal on each other is made possible by the peritoneum. It secretes a fluid which acts as a lubricant and thereby permits these movements without friction. The introduction of any agent which injures the peritoneum results in adhesions and limits these movements. Every effort should be made to limit the absorbing area of peritoneum exposed in case of infection and also to limit the area of morbidity which may result from such infection.

The quarantine principle is nature's own plan for accomplishing this and the peritoneum is the most efficient of all the body tissues in furnishing material for rapid construction of a quarantine wall. The peritoneum has the faculty of secreting or pouring out most efficient reparative material in great quantities when emergencies arise. For instance, if the appendix becomes infected or gangrenous, the peritoneum begins at once to secrete fluid which contains not only leucocytic warriors to fight the infection but plastic material for building a wall around it. Loops of bowel, omentum or any other movable intra-abdominal structures within reach of the involved area are brought to the field and cemented together by the thickening of this lymph. If the parts can be put at rest and the infection is not too aggressive, the area is soon effectively quarantined. Likewise, when an infection of the uterus extends into the tubes, or through the uterine wall, lymph is poured out in the neighborhood, which soon thickens and seals the ends of the tubes to the ovary or to other peritoneal tissues in the neighborhood. Intestines surround the pelvic organs and help to form the structures of a quarantine wall. Hence, it has long been known that the most important medical treatment of an infective or traumatic abdominal condition is production of absolute rest by every available means so that an effective quarantine wall may be constructed with the least possible interruption. To this end, food is kept out of the stomach, the stomach is washed, fluids are supplied in some other way, and peristaltic movements are stopped by large doses of opiates. Any foreign body introduced into the peritoneal cavity, or any traumatized area in which the normal epithelial lining of the peritoneum has been destroyed, is immediately quarantined in the same way.

Many times efforts of nature are entirely successful in quarantining a serious source of infection and are usually successful in healing a traumatized area. When nature fails, the aid of a surgeon is required. Nature may entirely fail, may be but partially successful or may leave bad after-results. In the case of a large source

of infection, such as follows perforation of some of the abdominal organs, for example the stomach or duodenum, nature
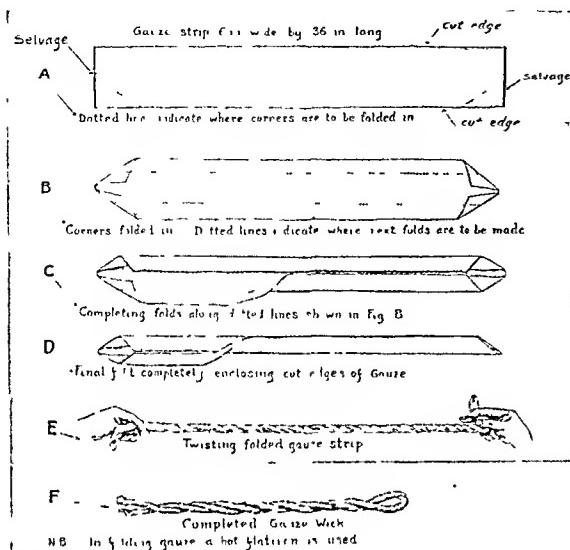
FIG. 1. Preparation of gauze wicks.

is usually inefficient. If the infection or invading enemy is limited in quantity but is very aggressive, as is the case in perforating appendicitis, nature's efforts to form a quarantine may be thwarted unless augmented by measures to stop peristalsis. When nature has been successful, usually a very strong wall is formed by an excessive amount of reparative material. The tissues within the enclosure of this wall often become necrotic and an abscess may be formed which may later be drained. After such repair, adhesions represent the residue of reparative material which has not been absorbed after the need for the wall has passed. These adhesions may result in troublesome morbidity.

The weakness of nature in defending herself is that she has no way of mechanically disposing of an enemy except to starve it or absorb it. Therefore, her first action is always to quarantine it. The primary function of the surgeon is to remove the infection or offending body from the abdominal cavity by mechanical measures or to repair the traumatized area. Many times it is not possible for the surgeon to remove the source of infection

entirely or to repair the diseased area completely. In such case, it becomes his duty to establish a surgical quarantine of this diseased, infected or traumatized area. By a proper quarantine, he may separate or segregate the diseased area entirely from the rest of the peritoneal cavity. In thus quarantining the disease, he is able also to drain the quarantined area separately, for this segment is extra-peritoneal in effect.

The importance of the quarantine principle was recognized by Mikulicz more than thirty years ago when from a thickness of gauze he made a sac into which he packed long strips of gauze laid in the sac back and forth like the folds of a fan, thereby interposing a large pack of gauze between the free peritoneal cavity and the diseased area. When it was desired to remove the pack, it was only necessary to withdraw this long strip of gauze which had been folded in the sac, thus leaving the empty sac as the only part of the drain in actual contact with the peritoneal surfaces. The late Joseph Price of Philadelphia, also Deaver, was very fond of using these large packs of gauze. In that stage of the development of abdominal surgery, this form of drainage properly used was a great life saver but it had serious drawbacks. The large amount of gauze within the abdomen produced an outflow of serum in proportion to the amount of surface of peritoneum thus contacted by the gauze. The relatively small piece of gauze coming out through the wound was soon blocked by the discharging debris. As a result, a large quantity of serum often accumulated around the gauze. Therefore, extensive adhesions were likely to follow such a drain. Furthermore, the removal of the sac containing the gauze strip sometimes broke down the plastic wall which nature had formed around it.

As modern surgical technique developed, the crudeness of this form of drain became more and more apparent. The pendulum swung to the other extreme, so that such able authorities as the late John G. Clark

of Philadelphia and Yates of Milwaukee brought out very convincing experimental evidence to prove that abdominal drainage

there was any excuse for drainage because this greatly reduced the postoperative anxiety.
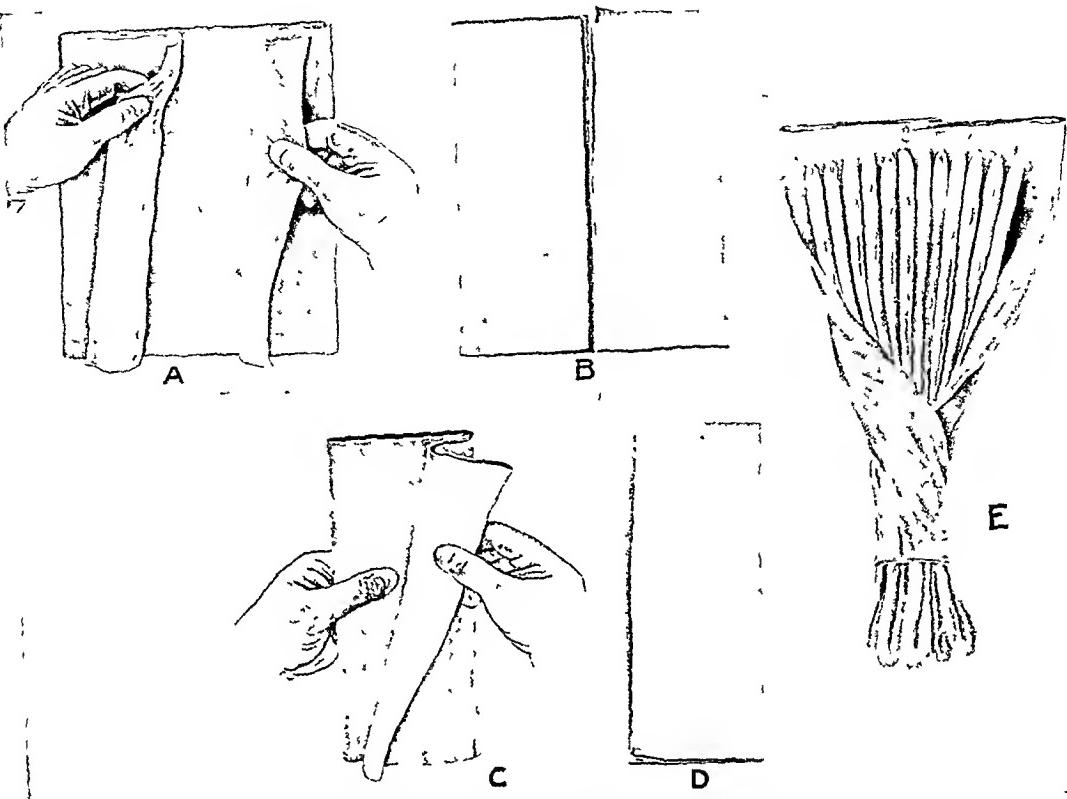
FIG. 2. Preparation of gutta-percha tissue. a, b, c, d folding gutta percha. e Structure of quarantine. Relation of gutta percha to wicks.

should be largely abandoned. Gauze drainage within the abdomen practically passed out of use, chiefly because it had been improperly used, for I think no one now would think of using gauze drainage directly in contact with intestines or omentum, except in rare emergencies.

About twenty-five years ago it was my fortune to do a great deal of my surgery in private houses in remote districts in which there were no trained nurses and relatively few doctors who had an adequate conception of asepsis or the after-care of abdominal cases. It was necessary to take a surgical nurse and all the equipment necessary to do an aseptic operation. Not the least important and hazardous part of such an operation was the after-care with the surgeon often far away. I soon learned that it was advisable to drain in every case in which

The Mikulicz drain was gradually abandoned and in the place of the large gauze pack was substituted a drain made up of a number of small wicks of gauze laid straight and altogether surrounded by sheets of rubber tissue. This greatly simplified the matter and made it safe for the local physician or nurse attendants to remove the wicks at the end of the first week and to remove the rubber tissue a week later. The results in these cases were so remarkably good as regards immediate mortality and postoperative morbidity, that the rationale of this particular type of drain became the subject of a good deal of experimental research and study. As the years went by, opportunity came for re-opening in cases in which this type of drain had been used, with the amazing revelation that there was almost a total absence of post-

operative adhesions, in direct contrast to results following the ordinary small tube drain or cigarette drain. Analysis of the

of an outside rubber tissue covering. The second is met by carefully arranging gauze wicks around the infected area. The

FIG. 3. Placing of wicks in quarantining pelvic organs.

mechanism of the drain brought forward the fact that its principal merit was that it was not simply a drain but a quarantine which segregated the diseased area from the remainder of the peritoneal cavity. Such a structure to be workable must possess the following qualities:[1]

1. The surface on the side of the general peritoneal cavity must be smooth and inoffensive to the abdominal organs coming in contact with it.

2. It must remain accurately in place.

3. It must provide ample drainage of the infected or injured segment.

4. It must be so constructed that it may be removed with the least possible trauma.

The first requirement is met by the use

[1] While all the principles of this quarantine have been used for twenty-five years in literally hundreds of cases and the quarantine has been roughly described in other articles on drainage, the full illustrated technique for the preparation and application of the quarantine was first published in *Annals of Surgery*, 85: 808, 1927.

gauze, being porous, rapidly fastens itself to the tissues where it is placed and thus anchors the quarantine. The third (ample drainage of the segregated area) is provided by gauze leading to the surface. Fourth, this gauze must be arranged in small wicks laid straight so that one may be withdrawn at a time without disturbing the defensive wall that nature has placed around the quarantine.

A very important detail is the construction of a wick that is strong and that at the same time has no ravelling edges. Such a wick is made from strips of gauze 5 or 6 inches in width, cut across a 30 inch bolt of gauze following a drawn thread. We have used Seabury and Johnson's Monitor gauze because of its strength. The steps in constructing this strip into a wick are shown in Figure 1. It will be seen that the ends of the wicks are formed by the two selvage edges of the bolt of gauze. All the cut edges are securely turned in and ironed with a flatiron and

the wicks twisted. The two ends are then brought together and again twisted. Six of these double wicks are placed in a

FIG. 4. Quarantine in place, showing two folds of gutta percha separating wicks from intestines.

package for sterilization. When unfolded for use, the two ends of the wick are untwisted from each other, but the pressing

FIG. 5. Quarantine emerging through abdominal incision as large cigarette drain.

and twisting used in the preparation prevents the wick from unfolding and exposing the raw edges. When put into place, each wick is laid separately, bringing the middle or loop to the surface. After the loop is cut, the two ends left in the

wound make two wicks to be removed. Twelve wicks of this kind are sufficient for holding a quarantine in place and

FIG. 6. Quarantine with wicks in appendix abscess cavity surrounded with gutta percha and leading from posterior wall to abdominal wound through peritoneal cavity.
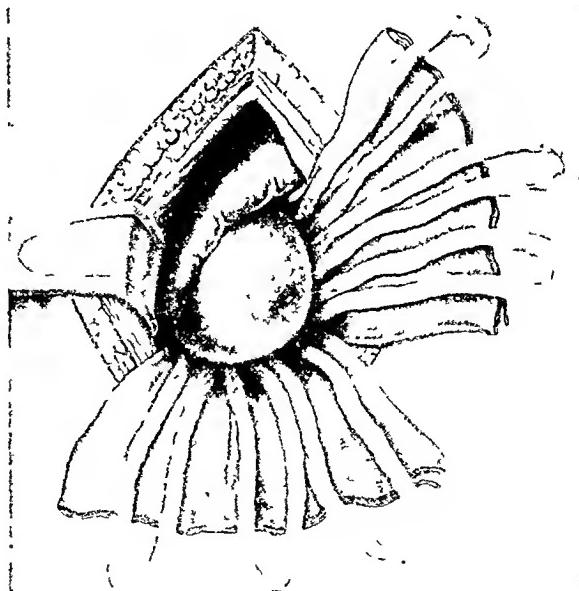
FIG. 7. Under local anesthesia, abdomen has been opened, intestines packed away and wicks placed in contact with posterior parietal peritoneum in front and back of gall bladder. Rubber tissue sheets placed external to it. Gall bladder is first aspirated, then split, contents removed. Opening in gall bladder left open either with or without drainage tube. Used in case of serious septic infection of gall bladder in feeble or seriously ill patient.

draining the area. When these twelve wicks are massed together, brought to the surface and surrounded by four thicknesses

gutta percha is prepared and preserved as follows:

Gutta percha, after it is cut in the
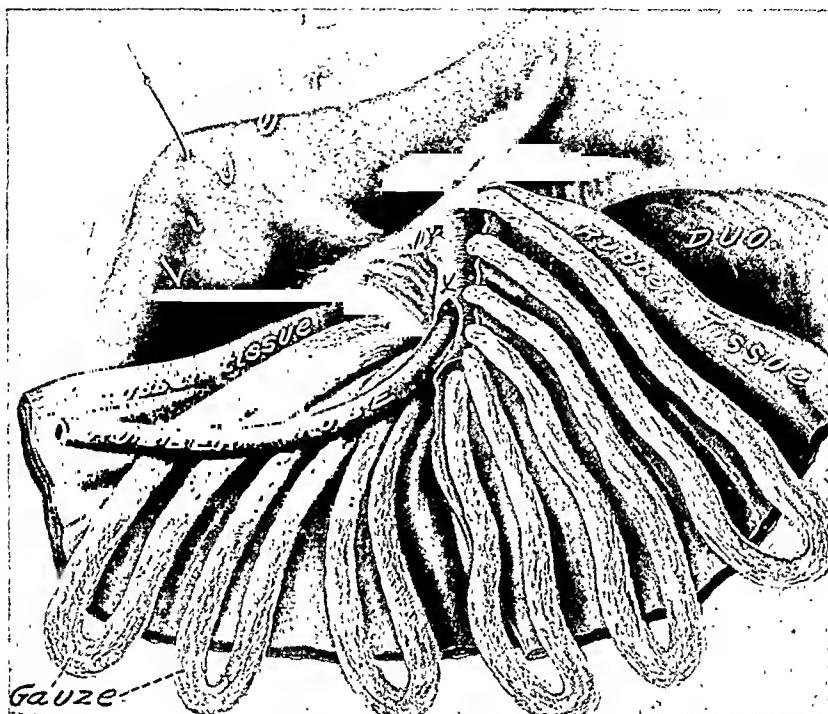
FIG. 8. Septic gall bladder has been removed, common duct has been split and emptied of stones, pus and other debris. Three double wicks are placed at entrance of foramen of Winslow external and posterior to duct. Three double wicks have been placed internal to duct. Two sheets of rubber tissue placed to surround wicks.

of rubber tissue, a made-in-cigarette drain approximately an inch in diameter is the result. The lower end is spread out in the shape of a fan (Fig. 2e) to surround the area to be quarantined.

The gutta-percha covering is constructed as follows: Seabury and Johnson extra-heavy tissue is used. It comes in bolts 5 yards long, 36 inches wide. This bolt is cut longitudinally into three strips 1 foot wide by 5 yards long. Each strip is cut in 18 inch lengths making ten pieces of tissue 12 by 18 inches. Each piece is folded in its long dimension to four thicknesses, making a four-ply sheet of rubber tissue 12 inches long, 4½ inches wide, in which all cut edges are turned in, leaving none but folded edges exposed. By this method of folding, the greatest strength of the gutta percha fiber is longitudinal and therefore the sheet will not tear transversely. Aseptically the

desired length, is put in 1:1000 bichloride and allowed to stand over night. It is then dried with sterile linen and folded, making it ready for use. It is kept in a glass jar which has been autoclaved or boiled. This is done with sterile gown and gloves.

It is easier to apply a rubber tissue covering in two pieces of 4½ inches' width than in one of 9 inches' width. Therefore, two pieces are always used, three if necessary to cover in the gauze effectively.

Meticulous care in the placing, as well as removing, of the quarantine is important. With long-handled forceps, the tip of each wick is placed where it is to remain in arranging the quarantine as shown in Figure 3. After the wicks have been laid straight, the sheets of four-ply gutta-percha tissue, described in Figures 2 and 4, are arranged so as to separate the gauze from the free peritoneal cavity. As the

quarantine passes through the abdominal wall, the rubber tissue completely surrounds the gauze forming a cigarette drain at this point which is spread out so as to surround the quarantined area at the bottom. The abdominal wall should not be drawn too tightly around the drain. The wicks are removed one at a time one week after they are placed. This may be done without anesthesia but a light gas anesthesia, lasting only a minute or two, is preferable. No force should be used in removing these wicks. With a pair of thumb forceps, each wick is pulled upon lightly to determine which one may be removed with least force. One week after the wicks have been removed, the sheets of gutta percha are easily removed altogether without gas. No other drainage is inserted after the gutta percha has been removed.

Speaking in terms of general principles, we have the following indications for the use of the quarantine in abdominal surgery:

1. Infected organs which tend to produce a peritonitis by contact or discharge but which organs are not to be removed.

2. Intra-abdominal abscess so located that the wall is exposed to the intra-abdominal viscera and where the discharge must be conducted across the free peritoneal cavity after drainage is established.

3. An open viscus which because of the presence of infection or for other reason it is impractical or undesirable to close at the time.

4. Large denuded bleeding or infected areas where it is impossible to cover with peritoneum.

5. Extensive recurrent adhesions which distrub the function of abdominal organs.

The specific indications for the quarantine are:

1. After operations for pelvic accumulation of pus (Figs. 3, 4, 5).

2. Septic infection following miscarriages and criminal abortions. Fever and other evidences of infection disappear almost magically after introduction of the simple quarantine.

3. Acute gonorrhoeal salpingitis in the

early stages while pus is exuding from the ends of the tubes but before the tubes have sealed firmly. Quarantine stops pertionitis
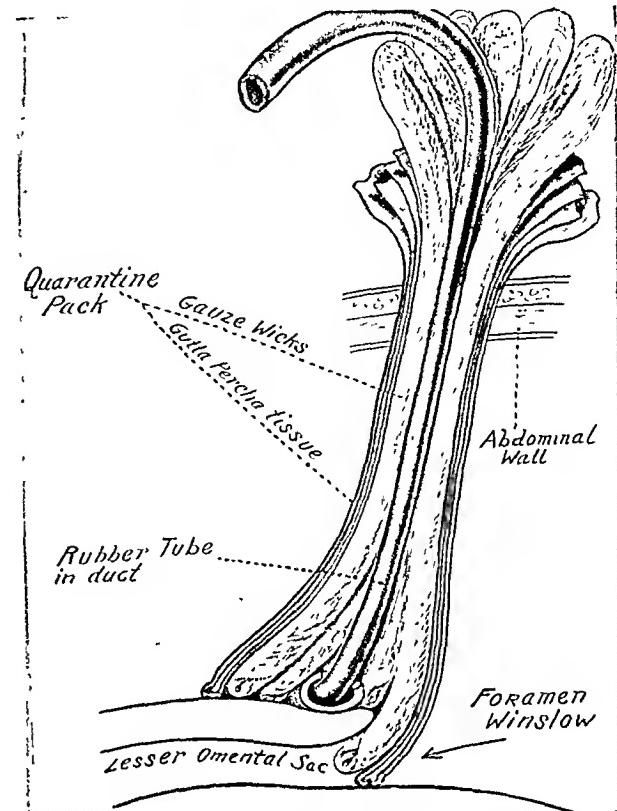
FIG. 9. Quarantine in place, showing section of quarantine as it passes through abdominal cavity from back to front.

and relieves symptoms immediately. We have never had to reoperate upon a case if the quarantine was placed before the tubes were sealed.

4. Extensive pelvic adhesions in which great disturbance is produced by attachment of the intestines to the pelvic organs. Cutting and separating the adhesions followed by the interposition of a quarantine gives most gratifying results.

5. Postoperative ileus in which the intestines have attached themselves to the pelvic organs the first two or three postoperative days. A quarantine placed early, separating the intestines from the pelvic organs, gives immediate and complete relief.

6. In a well-formed appendix abscess beneath the end of the cecum in which it is necessary to drain through the free perito-

neal cavity, the ends of the wicks are placed in the abscess cavity and the end of the rubber sheets extending farther

have occurred after a gall-bladder operation.

11. Our greatest success with rupture
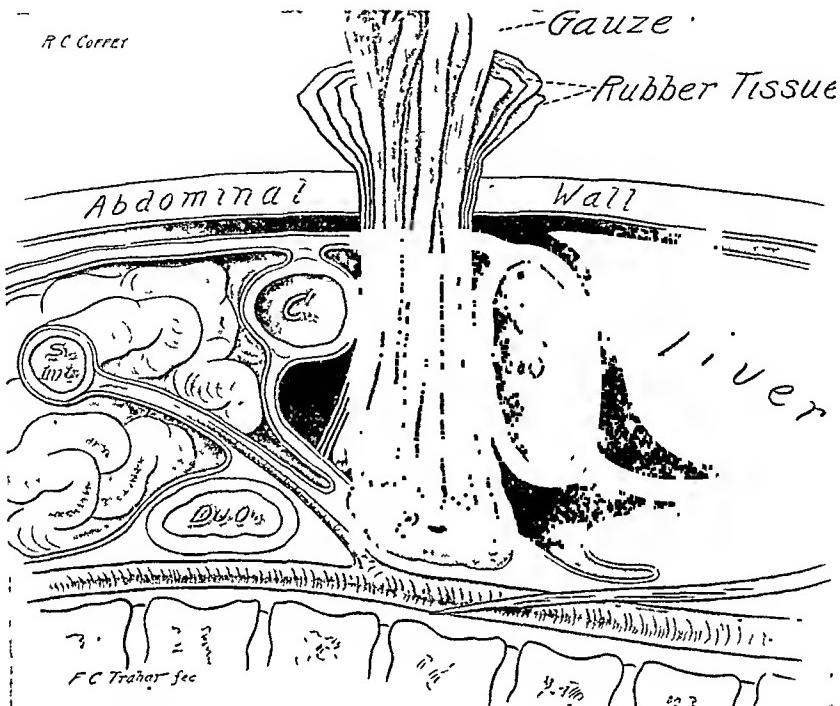
FIG. 10. Drainage of ruptured pancreas or in pancreas drained for acute pancreatitis.

down surround the abscess cavity and the gauze. Postoperative intestinal obstruction which follows the small cigarette drain in such cases is practically unknown if the abscess cavity has been quarantined. (Fig. 6.)

7. Septic or gangrenous gall bladder occurring in the aged may be quarantined and the gall bladder emptied under local anesthesia with relatively no shock to the patient. (Fig. 7.)

8. Common-duct operations in which there is pus in the field or in the ducts. A tube in the proximal duct with a quarantine surrounding the hole in the duct, and the area generally, effectively removes any danger of immediate infection and leaves a postoperative field remarkably free from adhesions. (Figs. 8 and 9.)

9. Quarantine is well adapted to surround a field from which a septic gall bladder has been removed.

10. Quarantine is very efficient in preventing the reformation of adhesions which

of the pancreas or acute pancreatitis with fat necrosis has been to push back the peritoneum covering the pancreas, place gauze wicks in contact with the denuded pancreas, surround the wicks with rubber tissue producing the quarantine. The drainage passes through the entire depth of the abdominal cavity without producing fat necrosis of the tissues as it passes through.

12. To surround two parallel intubated ends of intestines which have been brought out through a septic wound as an emergency and which are later to be closed by the Mikulicz plan.[1]

13. To hold back intestines from screened radium which has been placed within the abdomen for the treatment of cancer which cannot be entirely removed surgically.[2]

[1] See Annals of Surgery, June, 1927, article on Application of the Principle of the Quarantine in "Abdominal Surgery," Figs. 17 and 18.
[2] See Northwest Medicine, March, 1927, article on "Treatment of Cancer," Fig. 1.

14. Quarantine with multiple wicks is the only system of drainage which has been successful in the operation which

FIG. 11. Large quarantine drain placed in pelvis after first stage of operation for removal of cancer of rectum.[1]

we have described in "Principles of the Operation for Carcinoma of the Rectum."[1] We know of no one who has been successful with this type of operation for cancer of the rectum who has tried to substitute a small drain of any kind for the quarantine as shown in Figure 11.

15. We were never able to get uniform success in the operation of transplantation of the ureters until we adopted the quarantine of the lower pelvis which both kept the intestines from the infected area and permitted of retroperitoneal drainage. (Fig. 12.)

[1] Surg., Gynec. & Obst., 38: 723, 1924.

The protected quarantine herein described, which was devised twenty-five years ago to meet the conditions arising
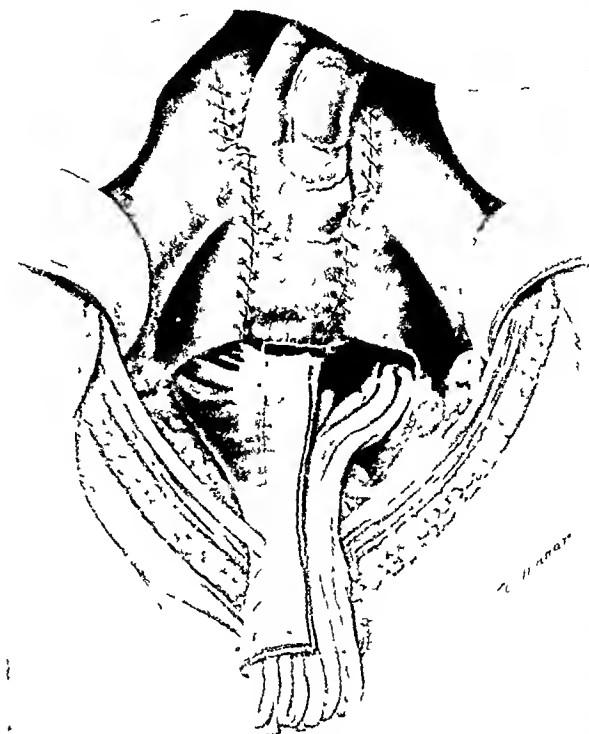
FIG. 12. Quarantine placed in operation for bilateral transplantation of ureters by tube technique.[1]

from diversified surgical conditions treated before the development of the modern hospital, has been constantly used during the intervening years in a great many and a great variety of cases. I believe it to be the most important principle which has entered into my surgical practice, both as regards the saving of lives and eliminating morbidity.

[1] Surg., Gynec., & Obst., 47. 593, 1928.

THE GENERALIZED TYPE OF
OSTEITIS FIBROSA CYSTICA
WITH A REPORT OF A CASE*

By William B. Coley, m.d., f.a.c.s., and Bradley L. Coley, m.d., f.a.c.s.

NEW YORK

INASMUCH as this condition, osteitis fibrosa cystica, generalized, is extremely rare, the following report of a recently observed case may prove of interest:

CASE REPORT

G. M., male, aged fifty years, a salesman by occupation, was admitted to the Hospital for Ruptured and Crippled on November 21, 1919 with the following history:

While on his way to the hospital to consult Dr. Virgil P. Gibney for a condition of weakness and pain in the legs which had persisted for seven or eight years, the automobile in which the patient was riding struck a truck and over-turned, imprisoning him. He was released and helped to his feet; immediately complained of very severe pain in the back.

On admission to the hospital he was suffering intense pain and had difficulty in breathing. The pain in the back was aggravated by any motion.

The patient's past history is of interest: He was seen at the Neurological Hospital and at Mount Sinai Hospital in 1915, at which time he complained of weakness of the left leg and left arm. There was marked atrophy of the left hand and both legs. Both reflexes were present. Wassermann: negative. At that time a diagnosis of amyotrophic lateral sclerosis was made. He remained in Mount Sinai for three weeks and was then discharged. It should be noted that Dr. I. Strauss at that time made a diagnosis of multiple myeloma.

Shortly thereafter his teeth were extracted in the belief that the pain might be due to focal infection from the teeth. According to the patient his health had been perfect until the age of thirty-five, or fifteen years previously.

At the age of thirty-five he had an attack of "sciatic rheumatism" lasting one year during which time he was treated with iodide of potash. About seven years later he first felt weakness and pain in both legs with "sticking" pains in the soles of the feet which persisted for about two months. He remained free from pain until the following winter when it recurred with increased severity and lasted for another two months after which it disappeared until 1913, when it again recurred. Iodides were again prescribed but refused. During these attacks the patient had difficulty in going up and down stairs. He had had no gastric crises, no urinary symptoms and was able to find his way about in the dark without difficulty.

From 1913 to 1919 he was laid up every winter with these attacks of pain and disability. In the summer months he had no pain but suffered from weakness of the same degree as that experienced during the winter months.

The patient stated that the nodules which were present on the anterior surface of the tibia had been present for only two months. According to him, six Wassermann reactions were reported negative.

Physical examination on November 22, 1919, by Doctors Kleinberg and Sneed, showed the back to be symmetrical and the spine in the median line. There was no knuckling of the spine nor any disturbance of the anteroposterior physiological curve of the spine. There was no pain nor tenderness referable to the spine. There was some inconstant tenderness of the ribs on the right side in the axillary region, to which region patient referred most of his pain. The back and spine appeared normal in the standing posture. The motions of the spine were practically entirely restricted.

Roentgen-ray Examination. "The plates are hazy and it is not possible to make a definite diagnosis. There appears however to be some crushing and diminution of the size of the ninth and tenth dorsal, and first and second lumbar vertebrae. It is distinctly advisable to take another series of plates after the patient had been properly prepared by catharsis and enemata, to confirm or deny their findings.

Although the roentgen-ray appears to point to a crushing or fracture of the vertebrae, the patient lacks the general important clinical symptoms, namely, localized pain and tenderness in the spine. In view of the history of prolonged pain in his legs and the roentgen-ray findings of distinct bone disease, it is possible that he has had for some time a similar bone lesion in the spine."

Examination revealed an enlargement, the size of a hazelnut, at the junction of the upper and middle thirds of the right tibia. The left tibia exhibited an enlargement the size of a hen's egg on its anterior surface in the middle third. On the left, the patella reflexes were barely perceptible. The plantar reflexes were exaggerated especially on the left side.

Diagnosis. Syphilitic (gummatous) enlargement of both tibiae and possibly the left femur and rib.

Wassermann reaction, November 24, 1919 reported negative.

Blood count, January 16, 1920:

R.B.C.................. 4,720,000
W.B.C..................   6,000
Hemoglobin............   85 per cent
Red cells normal
Polynuclears............   56.0 per cent
Lymphocytes...........   . 35.0 per cent
Eosinophiles............   3.5 per cent
Transitionals...........   2.5 per cent
Nucleated reds..........   none

Urinalysis December 8, 1919

Straw color   Neutral reaction
Slightly turbid   Sugar none
Scanty sediment   Albumin none
Specific gravity 1.011
No Bence Jones bodies; many granular casts.

Dr. Alfred Taylor saw the patient in consultation on November 24, 1919. He had lost much weight. His teeth showed considerable infection. There was no urine disturbance. Both lower extremities showed disturbance of knee jerks and ankle jerks. Both tibiae showed irregular bone enlargements. There was atrophy of both lower extremities and apparent weakness of muscle power. Roentgenograms were too indistinct to be satisfactory; however, they showed some apparent disturbance of the lower dorsal vertebrae. This combined with loss of strength and increased reflexes of the lower extremities suggested some disease of the vertebrae causing pressure on the anterior columns of the cord.

An operation was performed by Dr. Barrie on December 19, 1919: A vertical linear incision was made through the skin to the bone along the inner border of the left tibia at the junction of the middle and lower thirds. A wedge measuring 2½ inches by 1 inch was removed from the tibia and the contents scraped out. Owing to the very profuse hemorrhage which followed the curettage it was found necessary to pack the cavity very tightly and to leave the wound partially open.

Pathological Report (tissue removed from tibial cavity): "Giant-cell sarcoma. This tissue conforms with Dr. Barrie's hemorrhagic osteomyelitis."

Injections of the mixed toxins of erysipelas and Bacillus prodigiosus were given for several weeks. By January 5, 1920 the wound had healed. The patient was apparently benefitted by the treatment; and the disease showed little evidence of progress for a period of nearly five years.

In December, 1924 the patient appeared in Bellevue Hospital. At that time a section of the specimen removed in 1919 by Dr. Barrie, was sent to Dr. Symmers, Director of the Laboratories at Bellevue, who wrote as follows:

"The patient is now under observation in the First Medical Service of this institution under the care of Dr. Van Horn Norrie. He has multiple exquisitely painful bone tumors and, until your section arrived, we were all under the impression that the patient was suffering from multiple myelomata, although there was no Bence Jones protein in the urine. Examination of your section, however, seemed to show beyond doubt that the growths belong in the same category as that described by Barrie as hemorrhagic osteomyelitis and by Martland as multiple benign medullary tumors. The fact that the tumors are so painful, however, is a clinical argument against this diagnosis. Nevertheless, the microscopic examination would appear to set that doubt at rest."

The patient left Bellevue Hospital and was admitted to the Memorial Hospital on January 1, 1925. Physical examination at this time showed the left tibia occupied by a localized tumor the size of an egg on the anterior aspect. Several smaller nodules were found in this region. The right tibia showed the presence of a number of small nodules; both femora seemed thickened on palpation. There was a mass on the upper ribs of each side in the anterior maxil-

lary line. There was bony tenderness over most parts of the body except the skull.

Roentgen-ray report, January 7, 1925: "The
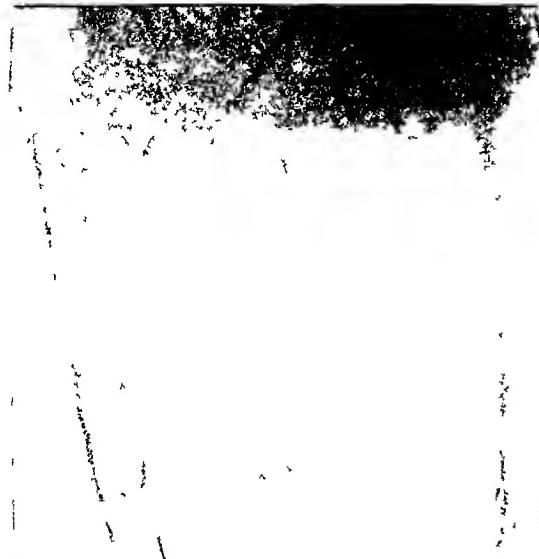
FIG. 1.

films reveal evidence of involvement of all the bones. *Diagnosis:* Von Recklinghaussen's disease or cystic osteitis fibrosa multiple."

Sections of Dr. Barrie's original operation were submitted to Dr. Ewing who reported as follows: "Osteitis fibrosa with giant-cell tumor. Many nuclei of large cells are very hyperchromatic."

Blood count taken January 4, 1925:

Hemoglobin.............. 75 per cent
R.B.C..................... 3,600,000
W.B.C.................... 17,000
Polynuclears............. 80 per cent

Blood chemistry taken January 9, 1925:

Urea nitrogen 14 mg. per 100 c.c.
Blood sugar .136 per cent
Uric acid 4.5 mg. per 100 c.c.

Treatment at Memorial Hospital: Low-voltage roentgen-ray treatment over both legs and both arms; thyroid extract, grains ½, O.D.; cod liver oil, oz. ½, T.I.D.; calcium lactate, grains 15, T.I.D.

No marked benefit was observed and the patient was discharged from the Memorial Hospital in the latter part of January, 1925. He was readmitted to the Hospital for Ruptured and Crippled on May 26, 1925, with a history of having fallen to the floor on the day of admission. He was carried to bed suffering excruciating pain in both legs.

Physical examination revealed nothing not previously noted with the exception of pathologic fracture of the middle third of both femora.

FIG. 2.

On June 1, 1925, under ethylene anesthesia, a double plaster spica was applied from axilla to toes, by Dr. Bradley L. Coley.

Blood examination, July 13, 1925:

R.B.C. 3,970,000
W.B.C 13,800
Polynuclear............. 88 per cent

The patient grew progressively weaker and died on July 15, 1925. After his death, some tissue was removed from the tumor of the tibia and examined microscopically by Dr. Ewing; this showed the same condition as was found at the exploratory operation performed six years previously, i.e., "giant-cell sarcoma."

The subject of osteitis fibrosa cystica has been so admirably and so exhaustively treated by Dr. John J. Morton,[1] former Assistant Professor of Surgery, Yale University School of Medicine, and now Professor of Surgery at the University of Rochester, that it is unnecessary to do little more than refer to his paper here.

[1] Morton, J. J. *Arch. Surg.,* 4: 1922.

According to Morton, the literature on this subject is very scarce, and aside from an article by Lötsch,[1] no extensive publica-

pain in the left knee. Physical examination in October, 1919, showed a marked outward bowing of both thighs, especially the right.

FIG. 3.

tion has been devoted to this type of the disease.

Morton gives a detailed description of his case illustrating it with photographs and roentgenograms. It is briefly as follows:

A man, aged twenty-three years, a lathe operator, came under the care of Dr. Morton on November 14, 1919, having been referred by Dr. Stanley Cox of Holyoke, Massachusetts. The chief complaint was bowing of the thigh bones. The patient's past history was negative except that three years previously, he had had an attack of erysipelas, lasting about three weeks; at the age of three years, he had fallen fracturing the right femur (good union) and at the age of four years, the right arm had been hit by a swing and broken just above the wrist.

He had no further trouble until he was twelve years of age, when he fell and was unable to walk for two or three days. At the age of sixteen, he fell over a railroad track and broke his right femur. He was laid up at the hospital for six weeks, the fracture uniting without complication. In March, 1919, he began to have pain above the right knee, and later on he felt some

[1] Lötsch. *Arch. f. klin. Chir.*, 107: 1–137, 1925.

FIG. 4.

Roentgenograms were taken of practically all the bones in the body, and the following condition was noted: The periosteum of the cranial bones was of normal appearance; the cortical bone was not thickened; but scattered through its substance were clear spaces, especially marked in the frontal and occipital regions. These spaces varied from the size of a pinhead to a pea and were surrounded by a slightly denser shadow. The vertebral column showed nothing worthy of note. The clavicles, scapulae, ribs and iliac bones were normal. The right humerus showed at the junction of the upper and middle thirds unmistakable early evidence of the disease process. Here the corti-

cal bone presented a thinning and spongy cystic formation, with slight reaction about the clear spaces. The periosteum was unchanged, and

FIG. 5.

there was no deformity of the bone. With the exception of the ribs and clavicles, most of the skeletal bones were found to be involved.

On January 5, 1920, a wedge-shaped osteotomy was performed on the femur, and a second operation was done in October, 1920. The cortical bone was found to be fairly soft in consistence and vascular. The specimen removed at the first operation was examined by Dr. V. C. Jacobson, Pathologist of the Peter Bent Brigham Hospital, whose diagnosis was osteitis fibrosa.

Morton divides these cases into two main groups, the first being without giant-cell sarcoma, and the second, with giant-cell sarcoma. We believe that his case belongs in the first group, and our own in the second group; and we shall confine our remarks chiefly to the latter group. Group 2 Morton subdivides as follows:
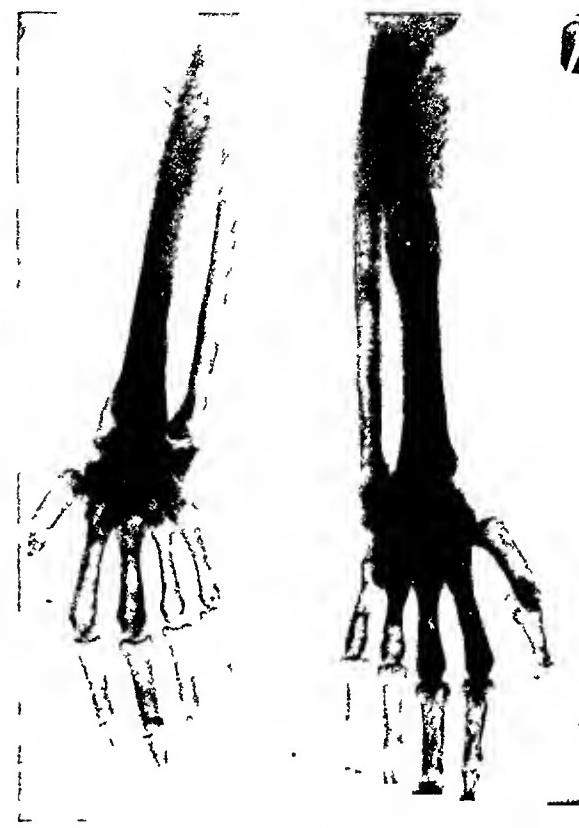
FIG. 6.

A. With cysts, fibrosis and giant-cell tumors, but no marked osteomalacia.

B1. With cysts, fibrosis and giant-cell tumors, and marked osteomalacia.

B2. With cysts, fibrosis, giant-cell tumors, osteomalacia and hyperostosis.

Morton was able to find only 17 cases associated with giant-cell sarcoma and osteomalacia. It is interesting to note that practically all of them proved fatal in the end, although death occurred at varying intervals, from two to twenty years. The condition is an extremely rare one and Morton states that not many cases have been reported; Barrie[1] was able to find but 4 in the American literature. One of these has been classed under Group 1 because of inadequate pathological data.

Apparently there is no definite age at which the disease is noted, Morton's

[1] Barrie. Ann. Surg. 71·581–593, 1920.

tabulated series showing the age to vary from nine to fifty years.

The chief symptoms are swelling, deformity, pain and fracture. According to Morton, there is no tendency to malignant change or to metastasis; but local recurrence is common unless operative removal is thorough. In subdivision A of Group 2, the prognosis is good and the disease is often cured by operation, although operation may have to be repeated for local recurrence. Morton found only 6 cases of this type in his collection.

In commenting on the pathology of the disease, Morton states as follows: "Von Recklinghaussen,[1] in his earliest description, regarded the disease as an inflammatory process, a chronic productive inflammation whereby fibrous tissue was substituted for bone structure, resembling in this way fibrous myocarditis or liver cirrhosis. In his later work he changed his belief and thought that he was dealing with a metaplasia of existing tissue and calcium withdrawal. Whichever view is correct the pathologic picture is fairly constant . . . The cysts always lie in the middle of the fibrous marrow at first and their walls are formed of thick fibrillae of this tissue, having a concentric arrangement and bound together by short strands. True epithelial or endothelial linings are lacking; but in spite of this the cavity walls are fairly smooth. The contents are usually fluid—thin or gelatinous, water clear, yellow or reddish according to the amount of blood extravasation. The changes noted occur in the beginning in circumscribed patches in individual bones. The whole bone becomes involved later by broadening out and confluence of the pathologically changed places. The epiphysis and periosteum, as a rule, remain unchanged. The metaphysis in young bone and the diaphysis in formed bone seem to be the places of predilection. The formation of the giant-cell tumors may or may not be extensive.

[1] von Recklinghausen. Rudolf Virchow, 1891. Festschr. Untersuchungen uber Rachitis and Osteomalacia. 1910.

In all cases, giant cells are present, but in one group in not sufficient numbers to form the masses of brown red tissue which

Fig. 7.

has received so many names and caused so much controversy as to its nature."

Morton believes there is now abundant pathological and clinical evidence at hand to establish firmly the benign nature of these giant-cell growths. They grow locally only, do not metastasize, recur only on incomplete removal, and may be removed by local operation several times is necessary. While the multiplicity of the tumors does not signify metastasis in the sense of an ordinary malignant neoplasm, it is hardly fair to classify these cases as benign inasmuch as in every one of them reported, the disease proved fatal within two to twenty years from the time of first observation.

There is practically nothing known about the cause of the disease. Personally we believe it to be of an infectious nature due to an unknown causative agent, a microorganism of some kind.

In regard to the differential diagnosis, this condition differs from the ordinary sarcoma in the multiplicity of the lesions,

the slow progress of the disease, the tendency to multiple fractures and the roentgenographic appearances of the bone.

marrow space, and the replacement of the cortical bone and its lack of definition from the marrow cavity constitute a
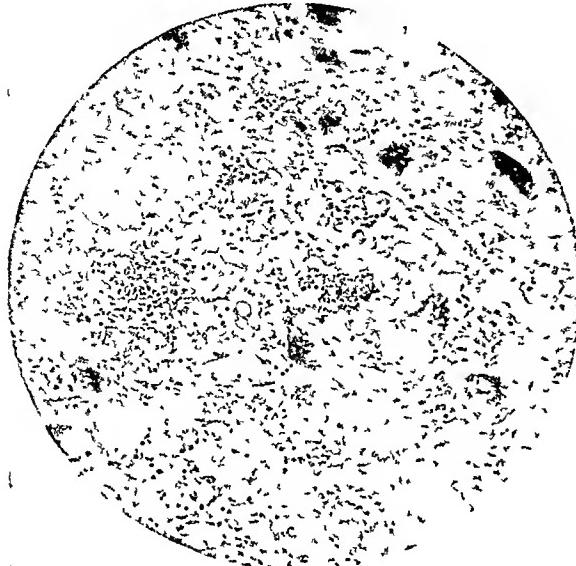
FIG. 8.

FIG. 9.

It can be differentiated from the ordinary osteomalacia from the fact that the symptoms are more severe and the deformities more pronounced. The roentgenographic appearances are fairly characteristic. The periosteum is not involved but remains smooth and normal in outline except at the site of a fracture. The process rarely involves the epiphyses or joints. Roentgen-ray examination of the bone marrow shows a widening of the marrow cavities and an irregularity in outline. The cortex often has a mottled appearance. As Morton so well describes it in his paper: "It is impossible at times to tell where the cortex leaves off and the marrow cavity begins, the process becomes so confluent. The whole bone picture is also striking because of the washed-out calcium content which gives a general translucence, and a honeycombed picture where cystic changes have occurred. Occasionally, cystic cavities show fine septal bridges making compartments, which some of the French observers compare to the cut surface of a tomato. Taken as a whole, the translucence of the bone, the irregular, rarefied patches and long porous streaks, the enlargement of the

picture not liable to be mistaken for any other condition. The bony deformities are marked, and the bones are angulated where fractures have occurred so that a smooth curve is not the usual finding. The bones show expansion and reinforcement on the concavity of the cortex, but the latter never of marked density."

Thus far, no method of treatment has been found that has any marked effect upon the progress of the disease. The treatment is purely symptomatic, treating the fractures as they occur and occasionally operating for correction of the deformities.

In regard to the prognosis, Morton states that those cases not associated with general malacia with or without giant-cell tumors, have the most favorable outlook; whereas in the other group in which there is a combination of general malacia with giant-cell tumors, the disease is practically always fatal.

In our own case it is not improbable that the course of treatment with the toxins of erysipelas and B. prodigiosus six years ago had an inhibitory action on the disease and prolonged the life of the patient, although, it is impossible to be sure of this.

REACTION TO IODINE

OF GOITERS FROM A GOITER AREA*

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A STUDY of the recent literature on the reaction of goiter to iodine shows striking differences of opinion concerning the theory of its action and also as to facts of observation. Some of the differences of observation may possibly be explained by variations of environment and for purposes of comparison a study of the reaction of iodine and goiter in Michigan has been made. Michigan lies in the Great Lakes goiter belt and has had careful goiter surveys made by the Michigan State Health Department. It was shown that the iodine content of the water varied from a mere trace in the region adjacent to Lake Superior to 880 parts to 100 billion in the southern part of the state. The incidence of goiter was inversely proportional to the amount of iodine in the drinking water. Since 1924 an iodine salt containing 1 part of sodium iodide to 5000 parts of table salt has been sold throughout the state and its use varies in different communities from 50 per cent to 95 per cent of all the table salt. It is estimated that each adult using this salt gets about 400 mg. of iodine per year.

For purposes of study a group of patients with hyperthyroidism treated by operation during a period in 1928 was selected. These were divided into two groups according to the pathological findings in the goiter, exophthalmic goiter and adenomatous goiter. All goiters with mixed findings, that is otherwise typical exophthalmic goiter but with adenomas, were excluded. All case histories were then gone over and any case not seeming to fall clearly into our clinical conception of these two types was excluded. All patients were questioned about the use of iodine and any having had recent iodine medication were also excluded from consideration. As a result of this selection, 128 cases of exophthalmic goiter and 50 cases of adenomatous goiter with hyperthyroidism were chosen, this representing the clinic ratio of these groups. All patients were given the same amount of iodine daily, as 1 c.c. of compound solution of iodine (Lugol's solution), this dosage being the one used by other clinics with which we wished to establish a comparison. We wished to determine:

1. A comparison of the reaction of exophthalmic goiter to that in a non-goiter area.

2. A comparison of the reaction of exophthalmic goiter and of the adenomatous goiter.

3. Facts regarding the reaction of the adenomatous goiters.

I. REACTION OF EXOPHTHALMIC GOITER

The general facts regarding the favorable influence of iodine on the preoperative and postoperative course of this disease are well established and our experience is in perfect accord. The effect of the iodine response was measured in terms of basal metabolism, while the clinical improvement and histological changes were typical of those described by many observers. An endeavor was made to have at least two or more pre-iodine metabolic rates but this was impossible in certain sick patients in whom the early use of iodine was a necessity and in these patients only a single pre-iodine metabolic rate was obtained. As a consequence the study is not absolutely accurate but since all data were collected under about the same conditions, we feel that it represents a fair

estimate of the reaction of exophthalmic goiter in the clinic to iodine. The data are shown in Figure 1. For purposes of com-
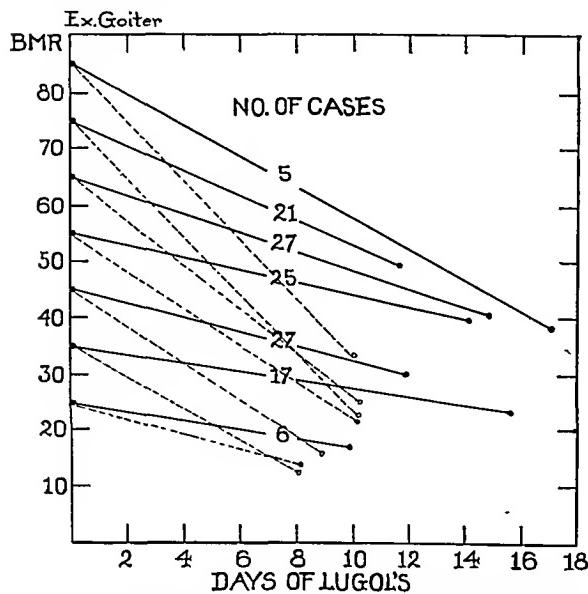
FIG. 1. Responses to iodine in exophthalmic goiter. Average basal metabolism before compared with that after iodine is used. Abscissae represent average time required for response. 128 cases divided into groups according to pre-iodine metabolic rates, each 10 point rise defining a group. Solid lines represent Michigan series. Dotted lines copied from Means' study of a similar number of cases. Number of cases refers to our group.

parison we chose the report of Means et al.[1] of a study of the iodine reaction in 128 cases of exophthalmic goiter from Massachusetts, a non-goiterous area on the seacoast. A comparison of the drop in the basal rate in the two series is shown graphically in Figure 1. In our series as in his the

declivity of the curves is in general related to the initial height; the greater the initial basal metabolic rate, the sharper the drop.
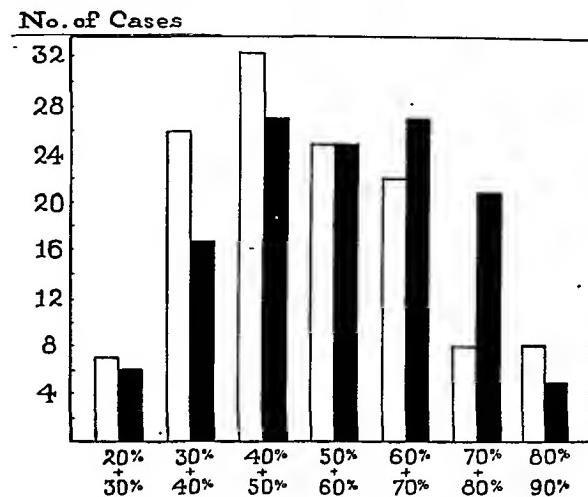
FIG. 2. Comparison of severity of cases in each series showing number of cases in each 10 point division of pre-iodine basal metabolism. Michigan series black, Means series unshaded.

There are two main differences noted. First, a longer period of time is necessary in our series to reach a base line and, second, the fall in basal metabolic rate is not as great. This is shown in Table 1, in which one can see that the fall of basal metabolic rate in Means' series is greater in all except the lowest group, the others dropping from an average of 4 to 24 points more than corresponding groups in our series.

Since the total number of cases in the two series is the same, a comparison between the severity of the cases can be made and this is shown in Figure 2. There is a slight preponderance in our series in the groups with a high basal metabolic rate. In the total number of our series 14, or 11.7 per cent, were refractory and did not react favorably to iodine in that there was no change in the basal metabolic rates after the ingestion of the amounts of iodine given to the others. These were not given larger amounts of iodine but were treated by operation without the occurrence of thyroid crises which was thought to be due to the iodine although it did not cause any marked preoperative drop in

TABLE 1

TABULAR COMPARISON OF REACTIONS OF TWO SERIES OF EXOPHTHALMIC GOITER TO IODINE, SHOWING GREATER RESPONSE IN MEANS' SERIES

Group by B.M.R.	B.M.R. FOLLOWING IODINE				Difference
	Means Series	Days	Present Series	Days	
80–90%	34+	10	38+	17	4
70–80	24+	10	48+	12	24
60–70	26+	10	40+	14	14
50–60	24+	10	39+	14	15
40–50	18+	9	30+	12	12
30–40	15+	8	23+	16	8
20–30	17+	8	17+	10	0

basal metabolic rate. The occurrence of these cases in any group causes a flattening of the declivity and lengthening of the

ADENOMATOUS GOITER
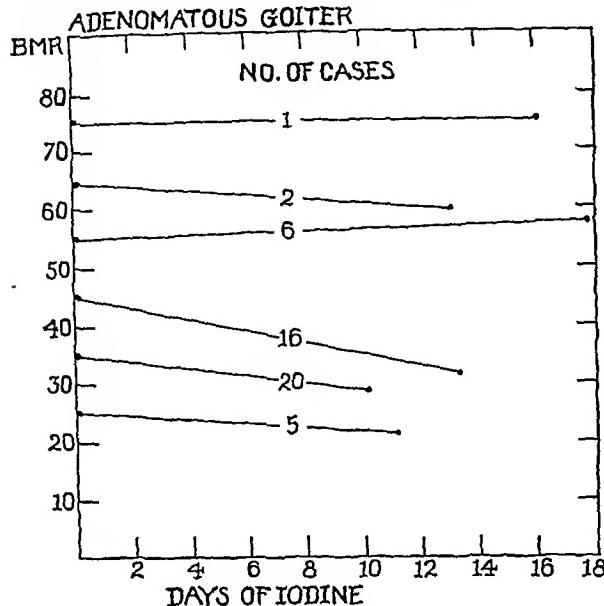
FIG. 3. Response to iodine in adenomatous goiter with hyperthyroidism. Average basal metabolism before compared with that after iodine is used. 50 cases divided into groups according to pre-iodine basal metabolism rates, each 10 point rise defining a group.

curve and may partially account for these differences in the two series.

From these observations we can state that our series of cases of exophthalmic goiter reacts less actively and arrives at a base line more slowly than a series of similar cases from a non-goitrous area. It may be thought that the use of an iodized table salt has produced an iodine refractory state in the goiters from this area but it is our impression that this same condition existed in the year prior to the adoption of the general use of the iodized salt when iodine was used in the preoperative treatment of goiter. Unfortunately such a comparison of the iodine reaction before and after the use of iodized salt cannot be made on any worth while scale since frequent basal metabolic determinations were not made in our clinic during that time. It is not a matter of great practical importance to the patient since the use of iodine causes enough improvement to make operation safe and abolishes postoperative crises.

All of the cases in this group were operated upon without mortality and very few were operated upon by fractional
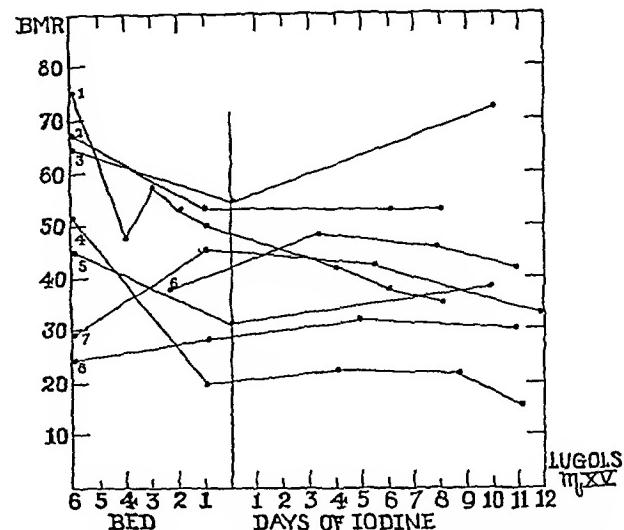
FIG. 4. Curves of basal metabolic rates in cases of adenomatous goiter with hyperthyroidism (1–8 incl.). Dots show basal metabolic determinations. Vertical line marks beginning of iodine.

methods. In none was ligation done and in 10 cases hemithyroidectomies were done at intervals.

II. REACTION OF ADENOMATOUS GOITER WITH HYPERTHYROIDISM (TOXIC ADENOMA)

This group of 50 cases entered the hospital during the same period of time as did the group of exophthalmic goiters. As stated they include only cases having all the pathological and clinical attributes of the typical adenomatous goiter. Many of them had the common cardiac complications of this disease. All of them were given rest in bed from seven to forty days before iodine was given. In most instances several basal metabolic rates were taken before and after the administration of iodine. The cases vary greatly in the duration of their hospital stay due to differences in severity of disease, and to sociological and financial considerations. In determining the effect of iodine we have estimated as closely as possible the average basal metabolic rate after bed rest, to compare with the rate after the administration of iodine. The length of time of

iodine administration varied greatly in that we were obliged to operate upon those patients earlier who were in fit condition
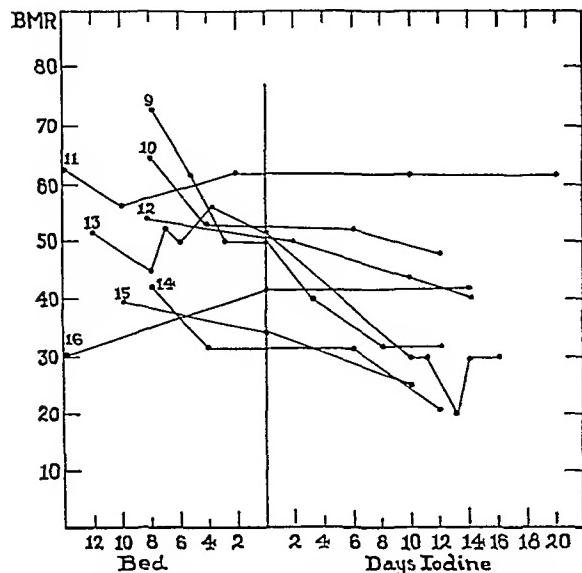
FIG. 5. Curves of basal metabolic rates in cases of adenomatous goiter with hyperthyroidism (9–16 incl.); 9 and 13 show very favorable response.

for it and keep for longer periods of time those who had cardiac or other complications. While the study is open to criticism in that perfectly even levels were not reached either before or after, the use of iodine, it offers a fair comparison with the group of exophthalmic goiters which was treated under similar conditions.

TABLE II

COMPARISON OF FALL IN BASAL METABOLISM WITH IODINE IN 128 CASES OF EXOPHTHALMIC GOITER AND 50 CASES OF ADENOMATOUS GOITER. SHOWING GREATER FALL IN EXOPHTHALMIC GOITER IN ALL EXCEPT ONE GROUP

Groups by B.M.R.	Fall of B.M.R. with Iodine				Difference
	Ex. Goiter	Days	Ad. Goiter	Days	
70–80	27	17	0	16	27
60–70	25	15	5	12	20
50–60	15	14	+3	18	18
40–50	14	12	14	14	0
30–40	12	16	6	10	6
20–30	10	10	3	11	7

The average reactions of this group to iodine are shown in Figure 3 for comparison

with Figure 1. The declivity of all the curves is less than in the exophthalmic goiter group and do not show the uniform
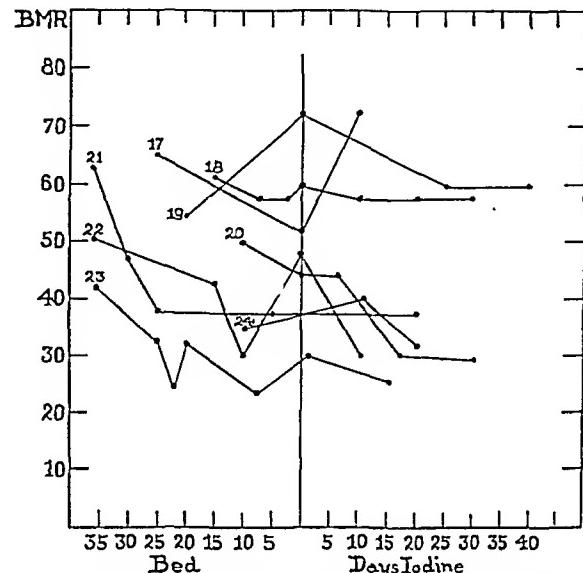
FIG. 6. Curves of basal metabolic rates in cases of adenomatous goiter with hyperthyroidism (17–24 incl.). This group were under observation longer periods of time. 17 shows unfavorable response.

downward trend. In one group there is actually an appreciable upward curve. In Table II is shown the average figures of these two groups, showing the fall in basal metabolic rate with the adenomas is much less in all except one group. Of all adenomas 23, or 46 per cent, were not affected favorably by iodine, contrasting with the 11.7 per cent of the exophthalmic goiters with the same lack of reaction. This factor was chiefly operative in flattening the declivity of the curve in the adenoma group.

III. OBSERVATIONS ON THE ADENOMAS

In Figures 4 to 7 are shown the actual curves before and after the use of iodine in 32 adenomas chosen as representative members of this group with varying periods of rest in bed and of days of iodine use. The striking fact about these reactions in general is the lack of uniformity of type. The initial metabolism is usually much higher than subsequent determinations showing the fallacy of regarding solitary observations as of great importance. A

remarkable improvement is noted with rest alone in many cases but several patients had a rise in rate after rest in bed. Sturgis[2] has pointed out that it takes several weeks of rest and familiarity with the test to arrive at a stabilized basal metabolic rate in cases of exophthalmic goiter and there may be fluctuations of metabolism of as much as 23 per cent from day to day. These facts make one doubt the absolute accuracy of any series of observations made over short periods of time and make their value only relative. A number of cases reacted brilliantly to iodine and interestingly enough only 4 cases were actually made worse by iodine. In several cases iodine was given from thirty to forty days without production of any iodine hyperthyroidism either in cases with original improvement from its use or in those that had remained unimproved by its use. Other cases remain perfectly unchanged by iodine. One must conclude from these observations that one cannot prophecy what the effect of iodine is going to be in any given case of adenomatous goiter with hyperthyroidism since it may vary from striking improvement, to no action, to marked increase in symptoms. Rest in bed alone causes a great improvement in many cases but may have no effect on others.

COMMENT

There is a difference of opinion as to whether adenomatous goiter with hyperthyroidism and exophthalmic goiter are two separate diseases. It has been commonly believed that while iodine has a beneficial effect on exophthalmic goiter it has a harmful effect on adenomas. Those who believe that fundamentally the diseases are one have attempted to show a similarity of response to iodine in the two conditions. Those who believe them to be separate entities state that iodine given to adenomas will cause iodine hyperthyroidism and increase the severity of the disease. There are two commonly accepted theories as to the mode of action of iodine,

that of Plummer[3] in which exophthalmic goiter is regarded as a dysthyroidism that is converted to a pure hyperthyroidism
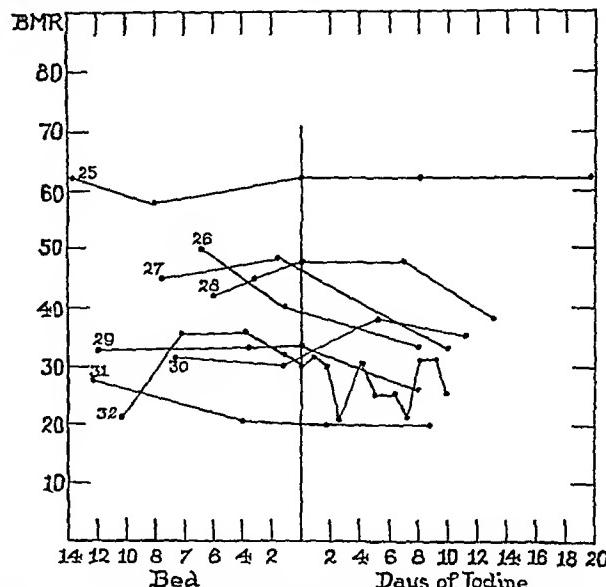
Fig. 7. Curves of basal metabolic rates in cases of adenomatous goiter with hyperthyroidism (25–32 incl.).

by the use of iodine, and that of Marine[4] who regards the rapid distention of the alveoli with colloid as causing a pressure retention with temporary blocking of excretion which is soon compensated for, with a return of symptoms. It has been asserted that differences in reaction of exophthalmic goiter and adenomatous goiter to iodine prove them separate disease entities and it has also been asserted that similarities of reaction prove them identical disease entities. Certainly the distinction between or similar identity of those conditions need not rest on these reactions to iodine. Without entering the controversy, which is of only academic interest, if one regards them as the same disease they are markedly different phases of it, with pathological changes in the adenomas that have taken years to form and in the exophthalmic goiter that may occur in a few weeks.

On the basis of our findings we are unable to agree with those who assert them to be identical because of similar reactions to iodine. There is a uniformity of reaction in the exophthalmic goiter

that is lacking in the adenomas. The adenomas may react as favorably as exophthalmic goiter but many react unfavorably and others not at all, and no one can foretell what the reaction will be. It is possible that larger amounts of iodine might have altered the type of reaction but for this study we felt it necessary to use a constant amount in all cases. They may be related clinical entities but their reactions to iodine do not seem parallel enough to warrant this assumption on this point alone. Longer and more careful studies of these reactions are necessary before we may be dogmatic.

On the other hand we have observed but few cases of adenomas in which it appeared that harm was done by the use of iodine even if taken over periods of thirty to forty days and we feel that the dangers of inducing iodine hyperthyroidism or of increasing the severity of the disease are not great with patients under observation. That iodine hyperthyroidism does occur there can be no doubt since such cases are seen not infrequently, usually due to the unwise use of Lugol's solution, and we feel that iodine has no part in the non-operative treatment of adenomas but used as a preparation for operation it may be of great benefit and will not do harm if the patients are closely watched.

Since the introduction of iodized salt we have watched for evidence of iodine hyperthyroidism that could be ascribed to a use of the product and while an occasional patient is seen who believes such to be the case we have not been convinced that we have seen a single instance of hyperthyroidism due to the use of iodized table salt. This statement is of interest because of the rather widespread criticism of this method of giving iodine, on theoretical grounds by those not familiar with the actual results in the state.

Another reason for use of iodine in all cases of hyperthyroidism is that it is impossible at times to differentiate with assurance between the various kinds of goiter and if one withholds iodine from exophthalmic goiter or the mixed types in the belief that it is an adenomatous goiter there may occur distressing postoperative complications. When one is familiar with the wide range of pathological pictures that may occur in adenomas varying from acini capable of involution to histologically formless masses of calcification or cysts it is not strange that there occur variations in physiological response to iodine. Marine[5] has shown that certain adenomata would involute with iodine but that others had lost this power. It was not possible to tell from histological examination which adenomata would and which would not react to iodine. It seems logical to account for the difference in reaction of these goiters to iodine by the differences in the pathological condition in the gland, rather than assume that we are dealing with a variety of diseases. We believe that iodine should be used as a preoperative measure in all cases of adenomatous goiter with hyperthyroidism as well as in exophthalmic goiter, if the cases are carefully watched for the occasional untoward reaction. We do not find enough similarity of reaction to iodine between the adenomatous goiter with hyperthyroidism and exophthalmic goiter to warrant the assumption that they are the same disease even though such may be the case.

CONCLUSIONS

1. A comparison of the reaction to iodine of exophthalmic goiter from a goiter area and a non-goiter area shows that, in general, cases from the goiter area do not improve as much and react more slowly.

2. In 11.7 per cent of cases of exophthalmic goiters no drop in basal metabolic rate occurred with iodine.

3. Adenomatous goiters with hyperthyroidism do not react to similar amounts of iodine in a manner enough like exophthalmic goiter to warrant the assumption on this ground alone that they are the same disease.

4. In 46 per cent of the adenomatous goiters with hyperthyroidism a favorable reaction was not obtained.

5. One cannot prophecy what the reaction in adenomatous goiters will be since it varies between brilliant improvement, to positive harm.

6. The use of iodine as a preoperative measure in all cases of adenomatous goiter with hyperthyroidism and of exophthalmic goiter is advocated.

7. The danger of inducing iodine hyperthyroidism in adenomatous goiter by preoperative iodine medication is small.

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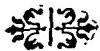
THE INTERDEPENDENCE OF

THE THYROID, ADRENALS & NERVOUS SYSTEM*

G. W. CRILE, M.D., F.A.C.S.

CLEVELAND

THE nervous system may properly be considered as including not only those organisms and structures generally included in the central and vegetative nervous systems but also the adrenal and the thyroid glands, since the latter together with the former control the adaptive energy-transformation of animals. Adaptive energy-transformation is the one outstanding factor that distinguishes the animal from the plant. An animal may be regarded, therefore, as a higher plant to the equipment of which has been added a mechanism for adaptive energy-transformation, that is, the transformation of potential into kinetic energy. I still think this system may not illogically be designated as a "kinetic system."

The most outstanding and unique example of a continued activation of this group of organs which results in continued increase in energy-transformation is a state of hyperthyroidism.

In hyperthyroidism not only is there a continued increase of energy-transformation but from time to time there appear crises during which the transformation of energy is temporarily increased still further. In a thyroid crisis the organism is driven so intensively and its functions are so magnified that the crisis serves as a physiologic microscope through which are revealed more clearly certain functions of certain organs. I propose to discuss the nature of these thyroid crises and their exciting causes, the mechanism that produces them, their peculiar setting, and the factors that govern them, and to offer evidence in support of the conception that hyperthyroidism is not primarily a disease of the thyroid gland but is rather a disorder of the entire kinetic system as defined above.

The clinical analysis of thyroid crises shows that they can be precipitated by any one of only eight factors, six of which are intraorganic, that is, originate within the organism itself, while two may be applied artificially. The six intraorganic factors are: (1) emotional excitation, such as fear, anger, worry, etc.; (2) foreign and split proteins, such as infection, wound secretion, etc.; (3) asphyxia; (4) hemorrhage; (5) pain; (6) physical exertion. The two artificially produced factors are: (1) the induction of inhalation anesthesia, and (2) the injection of adrenalin.

Whether the crisis be precipitated by a single one or by several of these factors, or whether the crisis occur merely in the natural course of the disease, the symptoms, and in fatal cases the mode of death, are identical. There must be, therefore, some common factor which is activated by these divergent exciting conditions. What common factor in asphyxia, hemorrhage, physical injury, physical exertion, emotional strain, infection, is responsible for the thyroid crisis? Exclusive of the injection of adrenalin, each of the factors enumerated above produces an increased output of the specific hormone of the adrenal glands, as has been proved by researches by Cannon and others as well as by ourselves, researches which have shown that the adrenals are activated by every activation of the central nervous system.

Moreover, it is significant that no other natural factor such as rest, sleep, food and water, heat or cold, and no drug such as

sedatives, narcotics, digitalis, strophanthin, atropine, sodium bicarbonate and glucose, cathartics, calcium or magnesium, can produce a thyroid crisis. Even the administration of iodine or of thyroid extract cannot produce a thyroid crisis. Moreover, in the absence of the thyroid gland, or when after thyroidectomy hyperthyroidism has been replaced by myxedema, each of these specific excitants loses its effect. In the absence of the thyroid gland or in myxedema the injection of adrenalin also loses its specific effect. Under such conditions a thyroid crisis cannot be produced even though any of these factors may be sufficiently potent to destroy the organism and produce death.

The symptoms of hyperthyroidism and of the crises of hyperthyroidism are identical with the symptoms of hyperadrenalism—dilated pupils, flushed skin, sweating, increased metabolism, increased action of the heart. The injection of adrenalin of itself alone produces these symptoms, and each of these symptoms is present in hyperthyroidism; the injection of adrenalin in the presence of hyperthyroidism causes an increase in every one of these symptoms. These symptoms in themselves betray the intermediary between the adrenals and the thyroid gland. The adrenals act through the nervous system upon the thyroid gland; the thyroid gland acts through the nervous system upon the adrenals; each of these three depends upon the other two. It is for that reason that we consider the ductless glands as inherent parts of the nervous system itself.

Further evidence that neither the nervous system, the adrenals, nor the thyroid gland can be considered alone is found in the following facts: (1) Hyperthyroidism has never been seen in a case of Addison's disease; (2) the excision of one adrenal gland temporarily lessens the symptoms of hyperthyroidism to a degree comparable to the removal of one lobe of the thyroid gland; (3) in myxedema, adrenalin loses most of its physiologic effect; (4) deep narcotization with morphine nullifies the effect of adrenalin; (5) no case of hyperthyroidism has been observed in a cretin or in the presence of a normal thyroid gland; (6) the division of the innervation of the thyroid gland controls the disease to a great extent; (7) physiologic rest profoundly benefits a patient with hyperthyroidism; (8) excitation of the nervous system is the most potent cause of the disease and of the crises of the disease. Finally, each of the six specific agents enumerated above as factors in the causation of a crisis of hyperthyroidism are also common exciting causes of the disease. These six factors produce their protean effects primarily by activating the nervous system, which in turn activates the thyroid gland and the adrenals. One might as well try to separate the nucleus and the cytoplasm of a cell, or the negative and positive plates of a battery, and expect either to operate alone as to expect the adaptive transformation of energy to continue in the absence of the nervous system, the adrenals, or the thyroid gland, each of which is an essential part of the organic machine.

It would seem more profitable to identify and study the energy-transforming system as a whole, and to find some new designation for the disease, rather than to relate it to a single organ which does not originate the disease but only collaborates in its origin and in its continuation.

The outstanding characteristic of hyperthyroidism is the facilitation and acceleration of the production and discharge of potential energy through the collaboration of a definite group of organs. As the result of this acceleration the energy-transforming system is speeded up, and for this reason I believe that a better term than hyperthyroidism to apply to the disease would be "hyperkineticism." By proposing this name we do not assume that we are in possession of all the factors involved in this protean disease but simply suggest that it would seem more descriptive than our present term.

Let me now offer certain experimental evidence as to the interrelation of the nervous system, the adrenals, and the thyroid gland:

Years ago we found that the administration of iodine or of thyroid extract produced an early hyperchromatism of the brain cells followed by progressive chromatolysis. The administration of a single dose of adrenalin produced hyperchromatism of the brain cells; the repeated administration of adrenalin was followed by chromatolysis of the brain cells. Significant as these findings were, they have become increasingly so as the result of investigations now being made in the laboratories of the Cleveland Clinic by Dr. Beutner, who has found that the stainability of cells is apparently a direct indication of their electromotive force or potential. Dr. Beutner is investigating this point by the construction of certain artificial systems consisting of organic substances, which react to different stains in the same way as did the hyperchromatic and hypochromatic brain cells in our experiments, and produce an electromotive force which varies with the stainability as we have found the electromotive force of a tissue to vary with its stainability.

Since iodine is the essential content of the product of the thyroid gland, and in view of the specific effect of this product on metabolism, we would suspect that it governs the electric permeability of the cells of the body. In our researches we have found that after a latent period of twelve or more hours, iodine and thyroid extract each increases the electric conductivity and capacity of the organs and tissues of the body, in particular of the brain. In physical terms the change in the conductivity and capacity of a tissue signifies a change in the activity of that tissue. These physical changes, like the clinical changes due to thyroid activity, are lasting and not fleeting. Increased conductivity and increased capacity are associated with increased functional activity. These changes alone would increase oxidation and hence would increase basal metabolism.

These findings are comparable to those in similar physical measurements of plants, of growing tumors, of fertilized ova, of the ameba, etc. The argument may be advanced that what we have measured is a change in the concentration of the electrolytes in the tissues and cells or changes in blood supply. It is true that the changes in conductivity and capacity which we have measured are in part due to changes in electrolytic concentration, but changes in electrolytic concentration constitute an essential part of the mechanism of stimulation and appear coincidentally with changes in the permeability of the cell membranes. Moreover, in our experiments changes in conductivity and capacity have been found in tissues after death, when such changes must be independent of the circulation. These electrical changes run parallel with the clinical phenomena.

Our experiments have shown that the effect of adrenalin on the capacity and conductivity of tissues and organs is wholly different from the effect of thyroid extract and of iodine; that is, while the effects of thyroid extract and of iodine are not manifested until after a latent period of considerable length, adrenalin causes an immediate and a striking change in capacity, temperature and conductivity. Moreover, the effects of adrenalin last for only a few minutes while the effects of thyroid extract and of iodine last for hours and days.

The most striking characteristic of the adrenalin effect, however, is its unexpected selective action on the organs and tissues of the body; that is, adrenalin causes a sharp rise in the conductivity, temperature and capacity of the nervous tissue, but shows the opposite effect on the conductivity, temperature and capacity of all other tissues, with one notable exception, namely, the medulla of the adrenal gland itself. At first this highly selective action of adrenalin on the tissues and organs seemed incomprehensible until it occurred to us that differences in the potential of the organs of the body might well depend on this very effect.

We would expect that iodine and thyroid extract would raise the potential of the cells, and experiments performed in our laboratory have proved this to be the case. If iodine or thyroid extract increases the capacity of the cells and also the electric load of the cells, then we would expect that the adrenals and the nervous system would discharge the cells, would diminish their potential; and our experiments have indicated that this is the case.

As a result of our experiments it would appear that the organism has been evolved on the principle of electric control, and that it is the function of the adrenal glands and of the vegetative nervous system to establish and to maintain and adaptively to change the differences in potential among the different organs and tissues, in order to meet the conditions of struggle and survival, such as fighting or escaping, mating and procreating, combatting infection, etc. If this conception be true, then not only is there a collaboration between the adrenals and the thyroid but there is a collaboration among all the organs and tissues which are concerned not only with the struggle of life but with the maintenance of life itself. In accordance with this conception, if we were to measure the difference in potential between various organs and a neutral tissue such as fascia, we would expect to find that during life and consciousness a certain difference exists and that at death this difference is cancelled. We would expect to find that adrenalin would specifically alter differences in potential in the normal animal and that in myxedema it would exert but little effect on the difference in potential. We would expect that alterations in potential would be related to the physiologic activity of the various organs; and that the activity of the organs would be related to the thyroid hormone, which controls the conductivity for the longer periods, and to adrenalin, which controls the conductivity for shorter periods. These theoretical assumptions have been proved to be facts by the experiments performed in our laboratory by Dr. Telkes and Miss Rowland.

We may assume that the thyroid hormone by increasing the permeability increases the activity of the cells and organs, of the brain, in particular. Increased permeability would make more effective every kind of stimulation. This would be one of the essential factors of nervousness, perhaps the mechanism by which it is produced.

In myxedema, on the other hand, the conductivity, capacity and potential are decreased far below the normal level; and in consequence, the permeability, hence the facility of stimulation, is decreased proportionately. This would explain the decreased metabolism, the depressed facility for stimulation and the decreased bodily activities: dullness and lethargy, in clinical cases of myxedema. And as a climax to these observations we have found that when an animal is in myxedema, adrenalin has lost its striking control over the conductivity, capacity and potential, a finding which parallels the clinical observation of the lack of effect when adrenalin is injected into myxedematous patients.

Moreover, and of peculiar significance, has been our discovery of a *specific reaction of the medulla of the adrenal gland itself* to the injection of adrenalin. We have found that the injection of adrenalin into the vein of the ear of a rabbit causes a sharp rise in the conductivity and the capacity of the medulla of the adrenal, this effect being as striking as the effect of adrenalin on the brain, and in the same direction. It would appear from this finding that the medulla of the adrenals functions as nerve tissue; perhaps it is the brain of the vegetative system, its probable function being to charge up, that is, to energize the vegetative system. The embryologic origin of the medulla, the type of its cells and the kind of tumors that arise in it, all point to the same conclusion.

In his illuminating work on the adrenal gland and his interpretation of its function

along the lines of evolution, which was referred to in my Ether Day address, Cannon surely took an important step in the direction of this conception.

If we are correct in our belief based upon clinical and experimental investigations that the single agent which causes the acute exacerbations of hyperthyroidism is the adrenal, then it would follow that by the removal of one adrenal gland in cases of hyperthyroidism the factor of safety of the patient should be increased; that is, the removal of one adrenal, like the removal of one-half of the thyroid gland, should reduce the phenomena of hyperthyroidism. The objection may at once be raised that the factor of safety of the adrenal tissue is so great that the removal of one adrenal would show no effect. In normal cases this would be true, but in hyperthyroidism the factor of safety of the adrenal, like that of the thyroid, has been fully exhausted by excessive action and one would expect, in accordance with our conception at least, that by the removal of one adrenal, as by the removal of half of the thyroid gland, the phenomena of hyperthyroidism would be correspondingly reduced.

We have removed one adrenal gland in 10 cases of hyperthyroidism, and in those 10 cases the immediate clinical results were comparable to those which follow the removal of one lobe of the thyroid gland. The pulse rate was lowered, the nervousness, sweating and weakness decreased, the lost weight was regained, the untouched thyroid gland diminished in size and grew firm in texture, as after a successful ligation or a successful rest cure; and of equal significance, although the operation was much more severe and of longer duration than a thyroidectomy, there was but little postoperative reaction, that is, little so-called postoperative hyperthyroidism. And why should this not have been the case, for according to our point of view, part of the electric generative plant of the vegetative nervous system was removed! The result of this procedure was not as lasting as after the removal of one lobe of the thyroid gland. This evidence is too meager to be conclusive and is offered only as so much evidence in favor of our general thesis.

How interesting that the symptoms of hyperthyroidism are so completely "adrenal" in nature—the driven heart, the activated nerves, the increased metabolism, the sweating, the vasomotor instability, the dilated pupils, the increased pulse pressure, all of these show a sensitization due to adrenalin. What is accomplished so strikingly by merely cutting off the sympathetic nerve supply to the thyroid gland may apparently be achieved on a much greater scale by the removal of one of the generators instead of by merely severing some of the feed wires.

The thyroid is governed, at least largely, by its innervation; innervation is regulated largely by the adrenals; the adrenals are controlled by the brain and nerve centers, though chemical activity probably plays a rôle. The thyroid certainly cannot originate hyperplasia, the thyroid has hyperplasia imposed on it; the adrenal glands cannot stimulate themselves, stimulation is imposed upon them; the nerve receptors cannot engage in self-excitation, excitation is imposed on them by the physical and chemical forces of the external and internal environment. The entire nerve mechanism, the adrenals, the thyroid, and in a secondary sense other ductless glands, act reciprocally; that is, nerve tissue, the adrenals and the thyroid tissue collaborate in a stepping-up process, a stepping-up of activity. In certain individuals, because of some previously existing unknown factor, some chemical or physical unbalance, the normal controls become inefficient or are lost, and a reciprocal excitation continues after the environmental excitation that initiated the activity has ended.

PYLORIC OBSTRUCTION*

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THE opening through which the stomach and the duodenum communicate, the pylorus, is surrounded by one of the important sphincters in the body, both from a physiological and from a pathological point of view.

Anatomically this stoma is easily demonstrated on the living subject in the open abdomen. At first one sees the short, stubby, pyloric veins, the anterior being the more evident, then by traction on the stomach, pulling it upward and to the left, the pale circular ring at the site of the pylorus comes into view; or it can be demonstrated by invaginating the duodenal or the gastric wall directly through the opening. The function of the pylorus is that of regulating the traffic along what the Germans so aptly call the *Magenstrasse*, especially the control of duodenal regurgitation. This *Magenstrasse*, like other avenues of communication, is subject to traffic jams and we then have the familiar condition of pyloric obstruction. This may be due to a mechanical condition, or to a functional derangement which may be congenital or acquired.

Congenital hypertrophic pyloric obstruction is most commonly seen in infants, although it may fail to present symptoms until adult life, even after middle age. These adult cases may be mistaken and treated for ulcer or even cancer until operation reveals the true nature of the disorder.

Acquired pyloric obstruction has a varied etiology; its most frequent cause, as seen in the Lankenau Clinic, is ulcer of the duodenum by extension of the periulcerous exudate. We rarely see a juxtapyloric duodenal ulcer, and gastric ulcers likewise are usually distal to the pylorus on the lesser curvature, on the posterior wall near the lesser curvature, near the cardiac end, or on the anterior wall of the stomach.

In addition to ulcer, obstruction of the pylorus may be caused by tumors, cysts, and spasm of the circular muscle fibers of the terminal portion of the antrum, or by adhesions, the result of inflammation, binding the duodenum to the gall bladder, or to the under surface of the liver, a condition often seen in reoperation after cholecystectomy. In fact pyloric obstruction due to, and associated with, cholecystitis is not at all uncommon. It may, as already indicated, be the result of adhesions caused by the gall-bladder inflammation, compression in the pyloroduodenal region by an enlarged calculus, and a more or less adherent gall bladder, or a stone becoming wedged in the pyloroduodenal region.

A common condition, and one that presents many problems of etiology, diagnosis, and treatment, is incomplete obstruction due to pylorospasm. These cases require exhaustive study from every angle and especially from that of constitutional nervousness, and the nerve supply. The innervation of the stomach and its rôle in gastric disturbances is receiving ever-increasing attention; in fact, Charles H. Mayo has suggested division of the sympathetic nerve supply to the pylorus as a means of correcting pylorospasm. The stomach is supplied by the vagus and the sympathetic system; recent studies have shown the presence also of ganglia cells in the musculature and in the submucosa of the pylorus. In addition to the mixed supply from the aforenamed systems, the stomach is supplied by completely isolated sympathetic nerve branches.

It is entirely possible, indeed highly probable, that a neuritis or perineuritis of

the gastric nerves may form the beginning of the derangement that finally leads to ulcer, and eventually to cancer. The first stage would be a gastritis, the result of nervous irritation (which has been produced experimentally), which recently is being emphasized as a potent cause of pylorospasm. That this is not merely a theory is evidenced by the common experience of patients who give a clinical history of ulcer while at operation no ulcer is found. It is in these cases that follow-up observations show unsatisfactory results. The influence of the nervous system in the etiology of ulcer and of pylorospasm may also be responsible for the periodicity of ulcer symptoms, as mysterious to the patient as to the practitioner.

The chief interest in pyloric obstruction is getting the patient well, in short, treatment. Organic obstruction due to cicatricial stenosis is entirely and permanently relieved by gastroenterostomy. This is the ideal condition for this operation, about which I believe there is no difference of opinion among surgeons. If the obstruction is the result of a high duodenal ulcer, which it is in most instances, the ulcer may be disregarded so far as any operative attack upon it is concerned, and merely a posterior gastroenterostomy made; also where the obstruction has been the result of a gastric ulcer, gastoenterostomy is the indicated procedure. In obstruction caused by a pyloric carcinoma that has not metastasized and offers itself for excision, subtotal gastrectomy is more promising from the standpoint of relief of symptoms and of prolonging life. However, for the operator of small experience in gastric surgery it perhaps will be safer to do only a gastro-enterostomy. The surgeon of wide experience will not hesitate to do a subtotal gastric resection, provided metastasis is not too extensive. The presence of enlarged nodes in the gastrocolic omentum does not necessarily contraindicate partial gastrectomy. It is our practice to remove one or two of the nodes and submit them to immediate frozen-section examination. If the

report is negative we regard the case a favorable one for excision, and even if carcinomatous, in the absence of ascites and jaundice, it does not deter us from making the more extensive operation. The judgment of the individual surgeon will best decide the question. Here is where experience counts for most. In short, gastroenterostomy in carcinomatous obstruction of the pylorus has not, in our experience, been as satisfactory as subtotal gastrectomy, as evidenced by the immediate postoperative comfort as well as the remote results. In fact, I am often more than amazed with some of the results of subtotal gastrectomy in carcinomatous pyloric obstruction.

On the other hand, where the carcinomatous mass obstructs the pylorus and is not confined to the pyloric end of the stomach but extends well to the cardia end along the lesser curvature, the question of doing any operation arises. This condition very nearly approaches that met with in the leather-bottle stomach which, in our experience, only occasionally lends itself to complete gastrectomy. Right here let me say, fixation of the pyloric growth does not always forbid removal. Our follow-up records show some very satisfactory results of operation for fixed pyloric carcinoma, as far as results can be considered good in surgery for this deadly disease.

Obstruction by benign tumor is rare. While it is possible for a benign tumor or cyst to act as an etiologic factor in obstruction of the pylorus, it is unusual but it should be thought of. Recently, in one of our cases, such a tumor was a pedunculated fibroma that sprang from the posterior wall of the stomach near enough to the pylorus to cause intermittent obstruction. It was because of the latter that surgery was resorted to.

Pyloric obstruction caused by adhesions does not, as a rule, appear until organization of the new tissue and contraction has occurred. In a small percentage of instances, for example where either the

pylorus or the duodenum or both have become plastered to the under surface of the liver, but especially to the site of repair of the gall-bladder fossa, I have had to make a gastroenterostomy because the patient was rapidly declining due to persistent vomiting and the resulting inanition. In these circumstances operation is not done precipitately; it is best to wait until it has been demonstrated by lavage or by the barium meal or the raisin test meal that the stomach does not completely empty and there is retention. I believe a certain percentage of remote morbidity and even fatalities following operation for gallstone disease are the result of failure to recognize the presence of pyloric obstruction and failing to make the anastomosis early. This is one of the postoperative surgical misfortunes, similar to intestinal obstruction or vicious circle after gastroenterostomy, both of which sequelae have cost lives that might have been saved by timely reoperation. From my experience I cannot too strongly stress the importance of quick action in making these secondary operations. Watchful waiting will not win out in these cases while looking and acting immediately will. In these conditions do not allow the medical consultant, who is often asked to see the patient when the secondary operation is advised, to tie your hands by counseling delay in order to try measures that, in my opinion at least, are absolutely useless in these mechanical conditions. I have been embarrassed by having this situation arise and unfortunately have been forced to be expressive and not always in too polite phraseology.

In passing, it may be said that in addition to ulcer and cholecystitis, perigastric adhesions may result from disease of the pancreas, hernia, and epigastric trauma. Any of these may so change the contour of the stomach as to involve the pylorus. In exceptional cases, obstruction may also be due to extragastric causes from pressure of a tumor in adjacent organs—the liver, gall bladder, intestines, pancreas, etc. There are also instances on record in which the clinical history pointed as clearly as possible to pylorospasm and obstruction, in which the clinical tests showed the presence of sugar in the urine as well as a high blood sugar content and in which the gastric symptoms were entirely relieved by treatment of the diabetic condition.

Of the functional causes of incomplete pyloric obstruction, the most difficult to satisfy oneself as to its cause is pylorospasm. In the cases of epigastric pain where operation does not expose a lesion and in the unoperated cases where careful clinical study and laboratory tests do not reveal it, and treatment brings no relief we, as a rule, make a diagnosis of pylorospasm. The question is, are we right? Unfortunately, roentgen-ray and fluoroscopic study do not always help so that we are frequently placed in a more or less embarrassing position when being interrogated by an over-anxious patient or his friends.

If pylorospasm, as is claimed by some, is fundamentally due to disturbance of the vegetative and pneumogastric nervous system, the best procedure, if no lesion can be demonstrated, is the removal of the pyloric sphincter muscle, either its anterior half or in its entirety, the dissection of which divides the filaments of the vegetative and pneumongastric nerve supply to the muscle. This operation was devised by Payr of Leipzig, in 1924, and has been successfully used by him in cases where no other cause of pylorospasm could be found.

The most promising cases for removal of the anterior half of the pyloric sphincter are, I believe, those in which pylorospasm is associated with hyperacidity, where no other cause can be found, and where medical treatment has failed to relieve. We know that the majority of cases of duodenal ulcer present a high acidity; therefore, may not pylorospasm be a forerunner of ulcer, and if arrested, as we believe it can be by this operation, may not the formation of ulcer be prevented? This question is certainly worth considering. We all know the systemic effect of

spasticity of other sphincter muscles, for example the muscle of Oddi, the ileoceeal, and the rectosigmoid muscles.

In a number of eases when operating for gallstone disease or uleer or both, where there was marked spasm of the pylorus, I have made a longitudinal section of the pylorie sphincter, a modified Rammstedt operation. As you all know, chronic gall-bladder disease and ulcer very frequently coexist and the disorder is practically always aceompanied by pyloro-spasm. This is true, also, of chronic appendieitis, especially where the appendix occupies a high position. Chronie pyloro-spasm, therefore, is not an unusual condi-tion and eannot always be relieved by the removal of the major lesion, and if left undisturbed there may result a true hypertrophy with subsequent incomplete obstruetion. When exploring the upper abdomen I always make a point of ealling the attention of my students to the possibility of this funetional pylorie defect, and when it is present I am able to demon-strate it very elearly by irritating the angry pylorus by striking it lightly with the blunt end of the seissors or the handle of the sealpel.

Prompted by the good end-results of the cases in which I made the longitudinal section of the pyloric sphineter and also by Payr's reported sueeess with removal of the anterior half of the pyloric sphineter in functional pylorospasm, I concluded, after much thought that if Payr's opera-tion was successful in functional pyloro-spasm it would be worth a trial in duodenal ulcer sufficiently distal to the pylorus to permit removal of the anterior half of the musele, the idea being to do away with the neeessity of gastroenterostomy and the possibility of subsequent marginal uleer. I am now treating some duodenal uleers in this way, when feasible. Where there is periuleerous exudate about the pylorus, the operation is out of the question beeause the disseetion for remov-ing the muscle must be carried down on the anterior duodenal wall. I have been able to do the operation in small bleeding ulcers where I always excise the ulcer, also in a few cases of aeute perforated uleer. The dissection is a delicate one requiring great eare to avoid incising the mueous membrane. Up to the present my results have been satisfaetory. It has been suggested, and in faet earried out by Payr's assistant, Kortzeborn, to remove the posterior as well as the anterior half of the musele by opening the gastrohepatie omentum and earrying the duodenum forward. I have not yet done this beeause I have not given it suffieient eonsideration. The rationale of removing the anterior half of the pylorie sphincter musele is like that of gastroenterostomy, namely to allow the regurgitation of the duodenal contents to act upon the stomach eontents and thus neutralize the acid gastric juices and also to afford better drainage of the stomach. I wish to add that this operation does not apply to infantile congenital hypertrophic pyloric obstruction for which condition the Rammstedt operation still holds first place.

VALVULAR THORACOTOMY FOR EMPYEMA*

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THIS operation is apparently an old one; but little mention has been made of it in modern times. My attention was called to it by an article in the memorial volume to Prof. E. Forgue of Montpellier, France.

We have only a small series of cases; but the results obtained so far would seem to justify a further trial of this operation, and it seems to have some advantages over the customary procedures.

The three main features are:

1. *Valve Action.* A flap of skin and subcutaneous tissue which overlies the incision in the pleura and acts as a valve and imitates the natural mechanics of the thorax. On inspiration the cavity tends to become emptied of its contents, purulent material and air; with the collapse of the chest on expiration the flap is sucked into the hole and prevents the entrance of air, favoring of course the descent of the lung.

2. *Elimination of Tube Drainage.* Drainage is made by introducing one or more sheets of dental rubber dam, a generous portion being allowed to protrude within the thoracic cavity. We find this method of drainage ample and have been able in these cases to discard the use of a tube. The prolonged use of a tube has many disadvantages. It sometimes causes pressure necrosis on the ribs and invites the formation of long stiff-walled sinuses. Introduction of the dam is painless.

3. *Elimination of Rib Resection.* Possibly the greatest advantage is that so far we have been able to get perfectly satisfactory drainage without rib resection and its complications. As rib resection is unnecessary these operations can be performed with the greatest of ease and absolutely painlessly under local anesthesia and without shock, a great advantage in dealing with the desperately sick patient.

OPERATION

A suitable dose of morphine is administered (to adults) a half hour before operation.

The operative field is liberally infiltrated with ½ per cent neocaine solution. The flap is planned so that its center corresponds to the middle of the intercostal space to be entered. A rectangular flap about 2 inches by 5 inches, with the base above, is made. The flap is made rather large as when released it shrinks. It consists only of skin and subcutaneous tissue. Before penetrating the pleura an aspirating syringe should be reintroduced, definitely locating the pus. (Fig. 1.)

The intercostal tissues, after *infiltration*, are incised widely and the pleura opened. As the wound will not be very wide it should be quite long. A sheet of rubber dam a little wider than the flap, is introduced into the thoracotomy wound. (Figs. 2, 3.)

Originally we made various efforts to secure the rubber dam in place by suturing it either within the pleural cavity or to the external intercostal muscles. Subsequent experience shows that such suturing is unnecessary.

This procedure does not shock the patient at all. We make no attempts to evacuate the pleura at the time of its opening, preferring that this evacuation should take place gradually, as the patient is not so apt to be distressed by coughing.

The patient can take his usual nourishment at once and subsequent convalescence is simple. The rubber dam if not

sewn in place is renewed, usually daily or every other day, according to the amount and offensiveness of the discharge. Should

FIG. 1. Flap operation for empyema. First stage.

drainage seem to be imperfect or obviously so thick as possibly not to escape freely, irrigations from time to time with Dakin's solution will remedy the condition perfectly.

CASE REPORTS

We can report on 12 cases, although in only 8 was a typical flap operation done. We are including the others because some feature of this operation was employed, particularly the use of rubber dam. These operations have been done by several different operators, most of them by myself.

There were two deaths in this series. I mention them for the sake of completeness although the existing conditions really are not suitable for contrast with the others.

CASE IV.   Rose B., aged forty-two years. Transferred from Medical Service practically moribund on May 23, 1928. Under gas oxygen anesthesia a typical valvular thoracotomy was performed with rubber dam drain. Oxygen tent was immediately applied but condition grew steadily worse and died night of operation. Post-mortem examination revealed a large collection of fibrin beneath the right diaphragm and a patent foramen ovale in the heart. Culture showed Bacilli Friedlander, also gram positive bacillus which would only grow in fluid medium under anaerobic conditions.

CASE IX.   Lawrence W., aged two and one-half years.

Operation January 30, 1926 under ether

FIG. 2. Flap operation for empyema. Second stage.

anesthesia. Incision in 7th interspace evacuated considerable amount of pus. Rubber dam drain was inserted. On the 11th postoperative day, when child's condition had been perfectly good, he began to have a rise in temperature and subsequently developed measles. He was transferred to Willard Parker Hospital where he died.

FIG. 3. Flap operation for empyema. Third stage.

(It will be noted that this is not a flap operation.)

Culture of chest fluid showed non-hemolytic green-producing diplococcus. Identification of this organism was incomplete because subcultures failed to grow.

Of the eight typical cases the following is the abstract. One has already been

quoted as a fatal case. Six of the remaining 7 cases were done by me, all under local anesthesia.

eighth rib. There was much drainage. Culture showed Streptococcus non-hemolyticus.

There was apparently some backing-up of
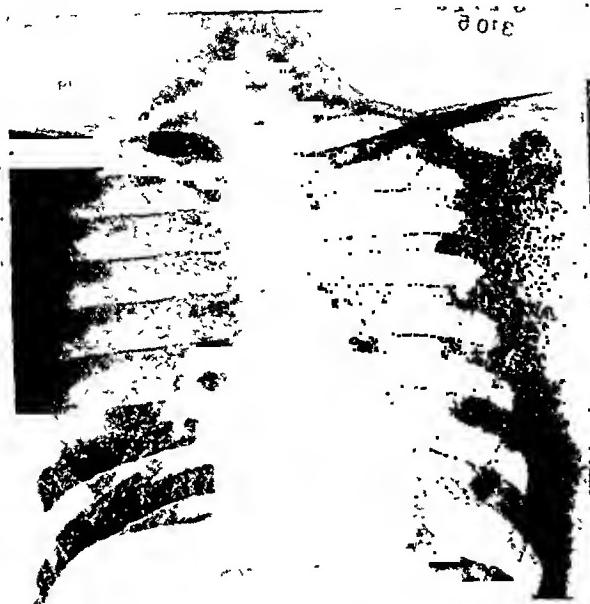
FIG. 4. Roentgenogram of Case I, taken four years after left valvular thoracotomy. No evidence of empyema.

FIG. 5. Roentgenogram of Case II, taken one year after left valvular thoracotomy. No evidence of empyema.

CASE I. Vito S., aged sixteen years.

Pneumonia five weeks previously, subsequently empyema.

Operation February 26, 1925. Drainage was made in the 7th interspace with typical flap under local anesthesia. Much thick pus was evacuated. Rubber dam was sutured to soft parts below 7th rib. Culture showed Streptococcus hemolyticus.

Discharge had ceased on the fifteenth postoperative day. Patient was discharged twenty-five days after operation in good shape.

Follow-up: January 17, 1926. Excellent condition. Gained 40 pounds.

March 27, 1929. Excellent health. No complaints of any kind. Chest expands normally and breath sounds are heard to the base. Roentgen-ray report: "The only evidence remaining is flattening of left diaphragm with obliteration of left costophrenic angle. Hilus shadows moderately increased; but no sign of pulmonary disease." (Fig. 4.)

CASE II. William T., aged forty-four years.

Admitted to Medical Service with lobar pneumonia. Transferred to Surgical Service and operated on March 14, 1928 under local anesthesia, with typical flap and rubber dam drainage, secured by catgut suture below the

pus. Carrel-Dakin treatment was instituted for five days, with immediate improvement. Patient was discharged on twenty-eighth postoperative day with discharge entirely ceased, and lung quite well expanded.

Follow-up: October 4, 1928. Working hard. Lung resonance normal. Gained 40 pounds.

Roentgen-ray examination March 7, 1929: "Shows moderate fibrosis manifested by accentuation of linear markings." (Fig. 5.) Still in splendid condition and working hard.

Figure 6 shows appearance of flap a year after operation.

CASE III. Catherine C., aged four and one-half years.

April 7, 1928: Roentgenogram showed signs of fluid in left chest. Aspiration yielded pus.

Operation April 21, 1928 under ether anesthesia: Thoracotomy with typical flap through 7th interspace. Large amount of thick yellow pus was evacuated. Culture showed pneumococcus Group 1. Rubber dam inserted in cavity and sutured to lower edge of pleural cavity. Convalescence was rapid. Wound all healed and patient sent to country on twenty-fourth postoperative day.

Follow-up: March 21, 1929. Excellent condition. Roentgen-ray report: "Hilus shadows and

linear markings slightly increased. Diaphragm low and smooth and no longer any evidence of empyema." (Fig. 7.)

Roentgen-ray, Mar. 27, 1929: "The left thoracic cavity is smaller than the right. Diaphragm is low; but shows dense adhesion

Fig. 6. Case II. Appearance of flap one year after operation

CASE IV. Rose B., aged forty-two years. (This case has already been quoted as a fatal case.)

CASE V. Christopher D., aged forty-seven years.

Admitted to Medical Service November 5, 1928, with lobar pneumonia. Under local anesthesia typical flap operation was performed. Much pus was evacuated. Rubber dam was inserted and anchored to edges of intercostal wound. Culture showed pneumococcus Group II.

Temperature gradually came down and remained normal for four weeks. On discharge thirty-second postoperative day wound was healed. Roentgen-ray picture showed no evidence of fluid in cavity.

Follow-up: March 21, 1929. Working. Excellent condition. Gained weight. Chest expanded normally and breath sounds were heard down to the base.

at its dome. Linear markings definitely increased in upper lobe of left lung with considerable studding and hazy increase in density near apex, probably due to thickening of pleura and also infiltration in lung. Trachea deviated to left; heart and mediastinum also slightly displaced to left. Changes indicate old pleuritis with fibroid tuberculosis at the apex. No longer any evidence of an empyema." (Fig. 8.)

CASE VI. Josephine F., aged twenty-eight years.

Admitted to Medical Service November 13, 1928, with pneumonia. Transferred to Surgical Service November 24, 1928. Under local anesthesia typical flap operation was performed. Considerable thin purulent fluid, evacuated. Rubber dam drain was sutured to opening externally. Culture, showed pneumococcus Group II.

Patient was discharged on twenty-third postoperative day, wound practically healed.

Follow-up: March 21, 1929. Lung expanded fully and breath sounds were heard all the way down to the base. Flap had healed firmly and

FIG. 7. Roentgenogram of Case III, taken eleven months after left valvular thoracotomy. No evidence of empyema.

was not sensitive. Excellent condition. Gained much weight. Roentgen-ray report: "Hilus

CASE VII. Thomas C., aged fifty-two years.

Admitted to Medical Service January 23, 1929, with pneumonia. Transferred to Surgical Service, and operated on March 5, 1929. Under local anesthesia typical flap operation was performed. Culture showed pneumococcus Group IV.

Rubber dam drain was sutured in place to the external intercostal muscles. Patient is still under treatment; doing extremely well.

CASE VIII. Frances C., aged thirty-nine years.

Pneumonia some time prior to February 11, 1929. Blood culture showed Group IV pneumococcus. Four days before admission signs of effusion in left pleural cavity, proved by aspiration.

Operation March 11, 1929. Under local anesthesia typical flap operation was performed. Rubber dam was sutured to external intercostal muscles. Patient is still under treatment; very well although there was a very large amount of pus.

The following are not typical flap operations, but are cases in which some feature of the operation was employed:

CASE IX. Lawrence W., aged two and a half years.

FIG. 8. Roentgenogram of Case V, taken four months after left valvular thoracotomy. No evidence of empyema.
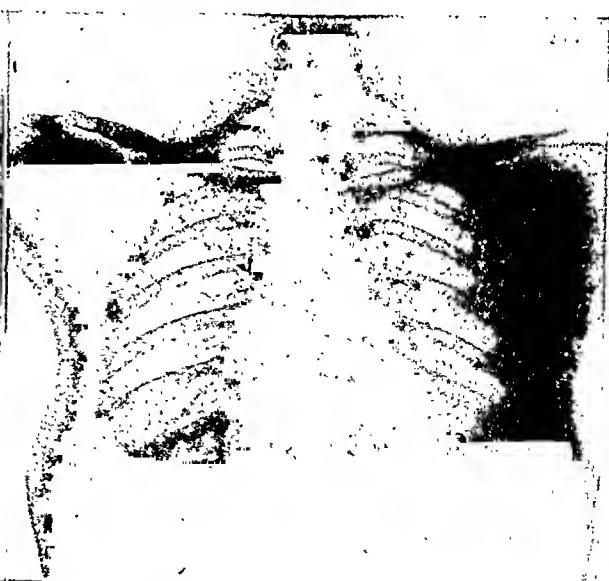
FIG. 9. Roentgenogram of Case VI, taken four months after left valvular thoracotomy. No evidence of empyema.

shadows moderately increased; linear markings normal. No evidence of thickened pleura or any remains of previous empyema." (Fig. 9.)

(This case has already been quoted as a fatal case.)

CASE X. Francis S., aged one year.

Operation Jan. 27, 1926 under ether anesthesia: Incision in 6th intercostal space, drained with rubber dam. Culture was negative. (Not a flap operation.)

Convalescence was very slow, complicated by rickets and malnutrition, and patient believed also to have measles.

Follow-up: March 21, 1929. Patient has grown and developed normally and is in excellent condition. Breath sounds are a little below normal around wound. Roentgen-ray report: "No longer any evidence of empyema. Diaphragms both smooth. Hilus shadows and linear markings of normal intensity. Bony fusion between the 5th and 6th ribs posteriorly."

CASE XI. Adolph E., aged fifty-one years.

Operation May 24, 1928 under gas oxygen anesthesia. Valvular flap was made but on account of seeming closeness of rib, operator decided to resect 1½ inches of the 7th rib. Culture of fluid was negative.

Convalescence was slow. Patient was discharged on the eighty-third postoperative day with small amount of drainage from the thoracic sinus. Roentgenogram showed definitely thickened pleura and partial contraction of lung. No fluid was present.

Wound was reopened December 6, 1928. Old sinus was explored and found rib had regenerated so as nearly to close off the opening. This new rib was removed. Only a small cavity was found with considerable thickened pleura. Wide opening was left for drainage.

Follow-up: March 21, 1929. Left chest did not expand fully and there was almost complete absence of breath sounds at the base. There were some exuberant granulations in the wound

from which there was slight discharge. Sinus was healed.

CASE XII. Thelbert P., aged fifteen years.

Operation March 6, 1929 under local anesthesia: Incision made in 8th interspace and considerable pus evacuated; rubber dam drain inserted into cavity. Culture showed pneumococcus Group I.

Skin flap had been outlined; but it was found subsequently not to cover the incision and therefore should not be counted as a typical operation.

Patient is still under treatment and improving. He had been treated medically for fifty-two days before being transferred to Surgical Service.

CONCLUSION

Our final impression is that the patients have made a somewhat quickly response to operative treatment and convalescence has been smoother.

As regards the period of complete healing it is hard to express any definite statement as conditions vary so much; but they certainly have been fully as prompt as the average.

Particularly gratifying are the follow-up results in which all patients have shown very marked restoration to health and physical examinations (which on several occasions have been confirmed by competent internists), have shown complete restoration of normal function of the lung. Finally the roentgen-ray results give certain proof of the complete permanent cure of this condition.

THYROIDECTOMY TECHNIQUE

THE POSTOPERATIVE CARE OF THE TOXIC GOITER PATIENT*

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THE technique of thyroidectomy has become so refined and so standardized that perhaps one should offer an apology for discussing the operation, but there are certain points in its performance which, if kept constantly in mind by the surgeon, will safeguard the patient against certain operative accidents and postoperative complications that are serious and often fatal.

The majority of deaths in former times was due to postoperative hyperthyroidism, but the modern methods of preparation of the goiter patient for operation have greatly lessened the dangers of this complication and it is no longer to be greatly feared by the experienced surgeon. The mortality today is largely due to complications that arise during and after the operation; those which arise during the operation are cardiac failure, massive hemorrhage, and suffocation due to injury to both recurrent laryngeal nerves and collapse of the trachea; those which arise postoperatively are hemorrhage, either massive or concealed, asphyxiation due to injury to both recurrent nerves or obstruction of the trachea from postoperative tracheitis, and mediastinitis from infection and pneumonia. Unquestionably a very frequent cause of death today is postoperative hemorrhage.

Efforts directed entirely to the prevention of these complications are, in the writer's mind, worthy of discussion, and for this reason a brief description will be given of a technique which has been used in our clinic for several years.

We employ a modified anoci-technique in that no patient knows the day of the operation. The night before is spent in restful sleep and in the morning, one-half an hour before the operation, the patient receives a hypodermic of morphine and atropine instead of the hypodermic of sterile water that has been used upon several previous mornings. She goes to the metabolism room believing that she is to have another test, but ethylene is administered instead. The attending physician and the members of the family do not see the patient before the operation. We use ethylene routinely in our surgical work and believe it especially valuable in thyroid work because it does not stimulate respiration or cause an increase in the secretion of mucus. The skin remains closed and the patient thus loses no fluids during the operation. We are unable to announce bluntly to our patients the time the operation is to be performed without causing mental and emotional excitement with a marked acceleration in the pulse rate. We have many charts to show the rapid rise in the pulse curve after this announcement has been made. This acceleration in the pulse continues during the night, is present in the morning and is markedly accelerated during the operation. A patient thus excited and stimulated is much more prone to develop postoperative hyperthyroidism than one not so stimulated. Another advantage of our method is the removal of an unnecessary additional cardiac load, which may not have an immediate effect, but a remote one upon an already strained and damaged myocardium.

There is no type of operation which calls for better team play than thyroidectomy. The first assistant should be a well-trained man and should work constantly with the

surgeon; the second assistant should also have training if he is to be a member of the goiter team. The operating room nurse is a valuable member of the team also; for if emergencies arise, delay upon her part may be fatal.

Should the surgeon use inhalation anesthesia in his work, the anesthetist should be one with a wide experience and special training in thyroid work. I know of no better way to safeguard the goiter patient than to have the anesthetic administered by one with skill obtained from a wide experience.

In order to do safe thyroid surgery, wide and ample exposure should always be obtained; the flaps should be widely separated and a single or double trap-door exposure should be made if necessary. The sternomastoid muscle may be separated from the sternothyroid and retracted outward to increase the exposure. It is wise at this step of the operation to ligate all the bleeding vessels; it is poor technique to have a dozen or more clamps in the wound before the attack upon the thyroid is begun. The sternothyroid muscle should be completely freed from the gland. It is best to lift the thyroid out of its bed by dividing the lateral thyroid veins before attempting to ligate either pole. In our clinic we do not rely entirely upon a mass ligature to secure the vessels of the upper pole but we believe that it is safer to ligate the individual vessels themselves, i.e., the superior thyroid artery and vein lying to the inner side of the pole; the descending branch lying behind the pole and the outer branch are clamped and divided separately. This technique is more troublesome and tedious but we believe it is safer than the mass ligature. It is, of course, important to be sure that no fibers of the severed muscles are included in the single or multiple ligatures as this will greatly increase the danger of postoperative hemorrhage. In the multiple ligature method it is surprising at times to observe with what ease long, tongue-like extensions of the superior thyroid pole may be rolled down-ward into the wound, often the vessels are divided, obviating the necessity of the wide upward exposure that is necessary when the pole is ligated with a single ligature.

We leave strips of thyroid tissue at both upper poles along the trachea, thus protecting the recurrent laryngeal nerves which lie close to the thyroid in this position, especially near the horn of the cricoid cartilage where the nerve comes forward out of the groove between the trachea and esophagus to enter the larynx behind the articulation of the inferior horn of the thyroid cartilage with the cricoid. If the horn of the thyroid cartilage is located with the finger and strips of thyroid are left superficial to this area there will be little danger of injury to the nerve. To protect the nerves at the lower pole, the forceps are placed parallel to the long axis of the neck high upon the gland and are never rotated during the ligating of the vessels. It was formerly thought that the lower pole was most frequently the site of nerve injury, but it is now well known that the injuries take place most frequently in the groove between the esophagus and trachea or near the upper pole. Operations upon injured nerves bear out this statement.

It is very important that the trachea should not be traumatized during the excision of the gland by rough handling or a too clean dissection, if the patient is to be spared postoperative tracheitis or temporary abductor paralysis, conditions which subject the patient to the risk of pulmonary complications. With this in mind, we have developed in our clinic what might be called an ever-changing attack upon the gland. The dissection continues in a direction that is compatible with absolutely quiet respiration, the direction of the attack being changed at once if the patient emits the slightest exaggerated respiratory sound.

Should the gland be substernal in type, we use the primary superior polar attack, believing that there will be less trauma to

the trachea and less danger of immediate massive hemorrhage from the deep inferior vessels. In the presence of a severe hemorrhage care and patience should be used in securing the vessel itself, as it is extremely dangerous to attempt to catch the vessel in a pool of blood. This hemorrhage may often be controlled by pinching the vessel back of the capsule with the fingers, which will enable one to clear the cavity of blood and catch the vessel accurately.

If the superior pole is ligated first and the gland further mobilized by ligating the lateral veins and the descending branches of the superior thyroid artery, it is surprising to see with what ease large substernal masses can be gently and easily delivered from the mediastinum—a much safer plan than first to deliver the substernal mass hurriedly into a wound that is already crowded with thyroid.

After the lobe has been removed all vessels are completely and securely tied with very fine catgut. We do not regard the simple granny knot as safe unless fixed by an additional tie.

The raw surface of the remaining thyroid should be given most careful attention and the oozing should be controlled by many ligatures or by careful whip stitching. In the hyperplastic gland this step in the operation may be very tedious and the parathyroids and the recurrent nerves may be subjected to trauma by placing the sutures too deep in the remnant of the gland. We have frequently left one or more hemostats upon the remnants of the gland after using a reasonable amount of effort to control rebellious oozing or we have occasionally used a small gauze pack.

We employ drainage in almost every case but remove our drains at the end of twenty-four or thirty-six hours. I am satisfied this drainage is sufficient in the majority of toxic cases to safeguard the patient against dangerous postoperative pressure symptoms or mediastinitis.

The patients in our clinic are all treated in private rooms, whether they are pay or charity cases. They are not left alone even for a few minutes. Severe postoperative hyperthyroidism is treated by morphine given in quantities sufficient to ensure rest; fluids, glucose and ice are used to control the temperature. The patient is carefully watched for postoperative massive hemorrhage or postoperative concealed hemorrhage and help is sought at once if the attendant is the least bit suspicious. The lives of five of my goiter patients have been saved by prompt and intelligent action upon the part of my junior resident staff. Every effort should be made to keep the trachea free of mucus, because an excess of mucus subjects the patient to the risk of aspiration pneumonia.

If the operation has been severe and there is great pain and difficulty upon swallowing, we use to great advantage an inlaying nasal tube, first suggested by Bartlett. Absolute quiet for a day is maintained; the patient sleeps much, is kept out of drafts and the trachea is kept free of mucus if possible.

Great care must be taken in the surgical management of the wounds, for these patients do not withstand wound infection well.

One can never afford, even though his experience in thyroid surgery becomes large, to be careless or rough in his operations upon the thyroid gland nor can he disregard the importance of meticulous postoperative care, for it is attention to these details in the management of goiter patients that spells success.

THE FIELD OF ELECTROSURGERY*

HOWARD A. KELLY, M.D., F.A.C.S.

BALTIMORE

IN spite of an evident slowly growing appreciation of the value of electro-surgery, the extensive application of this new principle still remains limited to the few more or less specializing in this field. My present plea is for its wider adoption as indispensable in our daily practice as general surgeons, in all our hospitals and above all in our teaching centers, that our young men may catch the inspiration of these radically new methods and carry them on to perfection.

The difficulties are those of all new ventures; as established, successful general surgeons we naturally grow set in our ways and look askance at radically new principles. The notion is also curiously current that electrosurgery is but another, perhaps somewhat more convenient and refined way of using the ancient hot iron and, therefore, negligible to that extent. An added objection of the *prima facies* sort is that it calls for switchings and sundry manipulations which are sources of delays and inconveniences. Further discouragement follows the discovery that it is after all not quite so easy of effective application as anticipated.

Noting these and other objections and making my most conciliatory bow to the objectors, I still insist that our younger men, with pliable brains and flexible fingers, should be given every chance to take the matter in hand and judge for themselves, for I have a supreme confidence that once turned into these inviting new channels, they will develop a refined and efficient surgical technique which will astound the next generation and help to mark a new era. Let me here stake any reputation I may have for prophetic vision and let the future decide.

The comparisons I shall make relate wholly to the usages of general surgery and the new electrosurgery. Radium and ray therapy I am not considering, as foreign to my immediate purpose. Nor shall I mention the electric principles involved, nor the apparatuses and various new tools fashioning themselves spontaneously under our hands as the field grows more familiar and its scope widens. Rather let me attempt to define the field itself and the opportunities it offers to the electrosurgical therapist. I first call attention as a background to some objectionable features in our general surgical work, to which we have become so accustomed that we are inclined to pass them over as negligible.

There is, for example, the more extensive use of a general anesthetic with its many drawbacks; the greater loss of blood, or, if the operator is meticulous in catching every vessel, in any big operation a painful loss of time; the objectionable, manipulative contacts with the tissues; the frequent, somewhat ruthless, clamping and crushing of tissues, especially when the bleeding vessel is not easily accessible; also, the numerous ligatures used, often preventing the advancement of the operation in a particular direction. In malignancy, the operator is often precluded from following up the invasion, owing to the impossibility of a clean unquestionable removal with scalpel or scissors. In our classical exsective surgery, in malignancy, experience teaches that it is almost invariably a matter of one throw of the dice, that everything must as a rule be done at the first sitting, for secondary operations supplementing the first are usually futile.

It is often impossible effectively to sterilize an infected wound. Ligatures and sutures are objectionable foreign bodies. Convalescence is often slow with much pain from the divided nerves and a resultant inferior scar.

Let me contrast our electrosurgery with this, with malignancy in view *par excellence*.

A simple sewing needle, a long stiff pointed wire, or a small flat disc are our common instruments. The concept of the surgical field, the arena of attack in a particular case, is identical with that of the general surgical viewpoint; the area to be handled aggressively is the same, the difference lying in the method of attack. There is, for example, the condemned umbra, the focus of the manifest disease and there is its circumambient penumbra, the encircling zone, more or less normal to the eye but practically always invaded by microscopical elements responsible for the too frequent recurrences *in loco*. Distressing experiences have taught us long since to make this penumbra ever wider and yet again wider. When the malignant invasion lies close to an eye or to the nose or about the mouth, however, the judgment of the best general surgeon is too often biased in his anxiety to avoid deformity, so he takes an unwarranted chance in lessening the penumbral area and risks a larger liability to a recurrence. Electrosurgery goes without hesitation to and beyond the prescribed limit, assured of a rapid recovery with pliable cicatrix without traction.

In electrosurgery, even extensive operations are often feasible under local anesthesia, classifying them in the ambulatory class.

An infected or ulcerated area can be sterilized with a thorough coagulation; the surrounding area is painted with 5 per cent mercurochrome, and a fine needle is plunged vertically into the tissues at the outer margin of the penumbra, in this way sequestrating or cutting off the whole area, cooking both nerves and vessels, lessening pain and bleeding and hastening extirpation.

George Wyeth's cutting current (acusector) is then used with surprising neatness and facility to undermine and lift the circumscribed area off in one sheet, reducing the liability to infection. Following this superficial extirpation, when the disease extends into the depths, the underlying areas are coagulated or desiccated and curetted away like soft cheese or removed in blocks by the acusector.

In this way the operation advances deeper and deeper until well beyond every suspected area, working easily it may be within narrow restrictions or at depths extremely embarrassing to the scalpel, such as well back in the throat, high up in the rectum, up in the bladder, deep in the pelvis or upper abdomen, or even down in the esophagus or in destroying a polyp in a bronchus!

Larger vessels seen in advance are isolated, caught, divided, and coagulated, and so sealed without a ligature, avoiding awkward delays, crushing tissues, and tedious insecure efforts at ligation. The best way to stop hemorrhage is to isolate the vessel as nearly as may be on the point of a forceps and then merely to rest the energized needle on the shank of the forceps, effectively sealing the vessel in a few seconds (Ward).

Healing *per primam* is the rule.

Categorically, and in some measure recapitulating, the superior advantages of electrosurgery are the following:

1. It destroys the tissues by a prompt necrobiosis *in loco*. In destroying, it sterilizes, rendering even seriously infected wounds innocuous.

2. It greatly reduces hemorrhage.

3. The tissues are not handled, squeezed, or compressed, but treated in situ and left to be thrown off or absorbed. There is no carbonization.

4. The use of ligatures is largely avoided.

5. The depth of the tissue from the surface, embarrassing to the general surgeon, is not a difficulty in electrosurgery.

6. The field of operation is reduced in size and limited to the extent of the disease or suspected area and does not in any way compromise the surrounding noninfected areas.

7. The depth of the destruction, easily

regulated to a millimeter or a fraction of a millimeter, can be extended at will, in marked contrast to the use of the Paquelin or the ordinary cautery.

8. The number of complications is greatly reduced.

9. There is as a rule no interference with primary union.

10. There is less pain following the operation and less after-use of sedatives.

11. Grafts take readily where large areas are left exposed to be epithelialized.

12. A recurrence of malignancy in a limited area is easily treated at any convenient time in the convalescence.

I would note the use of electrosurgery as preeminent in the following fields:

Infected and metastatic glands are often not dissected out but destroyed in situ and without interfering with the surrounding circulation. Following such a thorough treatment the wound can be closed, and the sterile, dead tissues left to absorb; or, it may be advisable to curette away its contents and then to destroy its capsule. Glands on the pelvic floor and in the crotch of mesenteric vessels are best treated in situ.

Infected small cysts, or cysts with superficial papillary growths can be sterilized completely.

Hemorrhoids especially are admirably treated by this electrocoagulation.

In the fractious adenomyomas high up in the rectovaginal septum, the treatment may be limited to the area affected and any neglected areas followed up speedily.

Electrosurgery is destined to remodel, I think, our treatment of breast cases; as for example, in dealing with the infra- and supra-clavicular glands, sometimes sterilizing them and leaving them in situ to be absorbed. To do this with safety, the operator must have experience with the method. The question of danger from the intervening lymph channels must also be settled.

As Ward has shown, an obstinate ranula can be treated in this way by simple incision, evacuation, and coagulation ("coction") of its lining membrane, fol-

lowed by closure. This I conjecture may also prove to be the best possible treatment of a hygroma which is opened and evacuated and the whole inner wall destroyed by coagulation or a heavy desiccation current and the incision closed.

I have treated a Bartholin cyst in the same manner.

In a large peritoneal hernial sac, I have coagulated the whole lining membrane rapidly and then left it in situ.

Papillary or cancerous implantations on the peritoneum are easily disposed of in this way, smaller ones in a fraction of a second—an enormous advantage over previous methods of excision and checking the hemorrhage by styptic, ligature, or suture. Implants on and infiltrations of the wall of the bowel, even extending through to the mucosa, can be rendered innocuous in loco and excluded in the direction of the bowel by sewing the adjacent peritoneum over them.

Omental metastases close up to the margin of the bowel can be destroyed with great security and without loss of blood.

I believe we shall find a field for electrosurgery in stomach operations for malignancy, in destroying the glands along the greater or lesser curvature and removing less of the organ. An enlarged gland felt deeper in above the stomach can also be destroyed in this way. We may, too, in time come to the excision of doubtful gastric ulcers with the electric needle, followed by direct suture, as preferable to our present more radical methods.

This treatment promises well in duodenal ulcer.

Electrosurgery is proving extremely effective in malignant diseases of the throat and of the upper jaw and in cooperation with radium.

In thyroid surgery, it may prove wiser to make a simple small incision, exposing the gland, to destroy a definite area by electrocoagulation, instead of the more time-consuming operative removal.

Harvey Cushing of Boston is opening up a wide field for electrosurgery in brain

and neural surgery, and Walter E. Dandy of the Johns Hopkins is advancing on similar lines. It takes but little imagination to envisage the numerous applications possible here.

In bladder surgery, in the removal of tumors and in dealing with ulcers either through the cystoscope or a suprapubic incision, we have a most fruitful field which we are only just entering.

The treatment of pigmented nevi is one of our triumphs; here one readily does a thoroughgoing satisfactory coagulating operation over an extensive area.

Electrosurgery is of great service in rectal carcinoma, cutting down the amount of disease to be radiated and even in attacking it in its invasion of the bowel wall, associated with the simultaneous direct application of heavy dosages of radium.

A danger in electrosurgery is in dividing muscular tissue, say, for example, the pectoralis major, close to a large vessel, where a sudden twitch may cause a momentary contact with a vessel and a serious hemorrhage, such as I have seen. There is also a danger in skeletonizing a small vessel up to its entrance into a trunk and holding it in a forceps and coagulating it. In such a case, the current strikes the trunk at the point of attachment to the big vessel in full force, risking a slough at that spot.

As a corollary to the above, one may add that the preparations for an electrosurgical operation, surrounded with all the necessary precautions for securing and maintaining a well-sterilized wound, are often not so extensive and time-consuming as for the average general surgical procedure, nor does the newer procedure entail the anxious after-care or anticipation of disagreeable sequelae.

This method, involving the adjustment of electricity in its higher potencies to the surgical field, is but a step in full accordance with the progressive scientific spirit of the age which today is predominantly electric. I venture to aver that these methods are far more surgical in the higher sense of the word in many cases than some of the cruder ways of general surgery as practised throughout the ages.

ISCHEMIC PARALYSIS*

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ISCHEMIC palsy or contracture is probably much more common than it is generally considered to be. It is certainly much more common than one would be led to believe from the number of cases appearing in the literature. In many instances the change is so slight that recovery occurs without any residue. In many instances the severer grades of palsy are not thought to be of sufficient interest to report.

The contracture may be so disabling that the function of the extremity affected may be practically lost. The mechanism of the production of the myositis should be thoroughly understood in order that prophylactic measures to prevent its development and operative procedures to limit its severity after it has commenced to develop may be instituted.

Ischemic myositis and gangrene are but different stages of the same process; the former may develop without the latter, and, on the other hand, a limited gangrene of the ends of the toes following a slowly developing stopping of the arterial circulation may develop without myositis. Ischemic myositis is the first stage of an acutely developing gangrene.

Various etiological factors have been emphasized from time to time as of first importance in the production of ischemic palsy. Especial emphasis has been placed upon constriction by circular casts or pressure by tightly applied splints. Scars which are found in some of the cases have been regarded as indicative of pressure. In some of these cases, however, the diagnosis of ischemic palsy hardly seems justified.

This is illustrated by a case observed by Brooks. His patient had had a fracture of the bones of the forearm which was treated by splints which were left on two weeks. When examined ten years later a marked contracture of the wrist in hyperextension with the thumb in a position of complete flexion and adduction across the palm was found. A large scar was present over the dorsal surface of the distal prominence of the radius and another deep scar where the end of the anterior splint rested in the palm. The patient gave a history of deep ulcerations being present when the splints were removed. There was marked atrophy of the extensor muscles of the forearm. An exploratory operation revealed that the extensor tendons were incorporated in a deep scar on the dorsum of the wrist. The bellies of the muscles were soft and showed normal nerve muscle reaction and no evidence of fibrosis. This contracture was due to cicatricial changes following a local deep pressure necrosis. There was no evidence of an ischemic myositis. It is quite probable that in some cases a diagnosis of ischemic myositis is not justified, and the scar is interpreted as the result of constriction, supposedly an etiological factor. Constriction by a tight cast or splint has been regarded by many surgeons as the principal, almost sole, cause of ischemic palsy occurring after fractures.

Leser, Kraske, Heidelberg and others have attempted to produce ischemic palsy experimentally by constriction. No one has succeeded however in producing a permanent, complete ischemic palsy in this way. The ichemic myositis produced in such experiments disappears after some weeks or months when the extremity is used. The contractures are not permanent as are many of the contractures observed in man. If an elastic bandage is allowed to remain too long gangrene develops. Vokmann believed that in the experiments in which a tight plaster of Paris cast was applied too few muscle fibers were involved; while in

the cases in which an elastic bandage was used, all the arteries were closed, gangrene developing.

Ligature of large arteries is rarely followed by any marked degree of myositis. Brooks, as a result of his experiments, states that "muscular weakness associated with a certain stiffness which follows the occlusion of a large artery may be a phenomenon of ischemia. Under such conditions one would not expect a complete paralysis and there would be no immediate manifestations of inflammation or contracture. This muscular weakness would be very likely to improve with the development of a more adequate collateral circulation. It would always be exaggerated by exertion and improve with rest. It is not associated with a fibrous transformation of the muscles. A complete muscular paralysis of any portion of an extremity which follows the occlusion of an artery is evidence of an anemia of the tissues incompatible with viability and usually signifies impending gangrene. With the development of gangrene the skin will almost certainly become necrotic to a higher level than the muscles. The permanent occlusion of a large artery is not followed by an acute inflammatory disease. Anemia and inflammation are incompatible pathological processes. Any condition, therefore, which develops within twenty-four to forty-eight hours and which is characterized by heat, swelling, pain and a subsequent fibrosis cannot be the result of permanent occlusion of an artery."

Kurt Krause has demonstrated that a tight or constricting dressing is not always an etiological factor in the development of ischemic palsy, and his observations have been substantiated by a number of observers. Of the 56 cases of ischemic palsy collected and studied by Hildebrand, 24 were not treated with a cast. Denucé studied and collected 97 cases of ischemic palsy; a circular cast had been applied in 42, splints in 19. In 36 of the cases no dressing had been applied. Nerve palsies have been interpreted frequently as indicating that the dressing which was used was tight or constricting, but nerve involvement according to Volkmann is

Fig. 1. Ischemic palsy. Antecubital fossa opened twenty-four hours after fracture, fourteen hours after beginning of cyanosis, swelling, pain and stiffness and fixation of fingers. Some myositis developed. Function of hand much improved by massage.

not a part of the clinical picture of ischemic palsy.

For the development of an ischemic myositis and infiltration, a sudden development of a venous stasis of a certain intensity is necessary. Ischemic contractures develop most frequently after certain fractures; those contractures which sometimes follow infections, freezing and burns are not being considered. This type of myositis and the subsequent contractures occur most frequently after fractures when the anatomical relations are such that the circulation through the principal vessels, especially the veins, may be interfered with by a hematoma or infiltration beneath a dense fascia. This type of lesion occurs most frequently after extension supracondylar of the humerus and fractures through the lower end of the femur. The relations in the antecubital and popliteal fossa are much the same. Ischemic palsy may be a complication of fractures of the bones of the forearm near the wrist, especially Colles' fracture. These are the fractures in which this disabling complication most frequently occurs.

Isolated ischemic contractures occur

almost only in children. They are, however, occasionally observed in older people, but the lesion which causes ischemic palsy

FIG. 2

in the young is apt to cause gangrene in the adult. Ischemic palsy occurs in the young instead of gangrene because of the healthy conditions of the artery, the greater possi-

FIG 3.

ischemic palsy or not. No particular attention was paid to nerve involvement in the cases originally studied by Volkmann.

FIG. 4.

FIGS. 2–4. Ischemic palsy, six months after fracture. Results of treatment of fracture indicated in roentgenograms Contractures of mild type reacting readily to elastic traction

Nerves may be involved, but not infrequently the injuries are direct. The extension fracture in the lower end of the humerus is the fracture after which ischemic palsy is most commonly observed. This is also the fracture in which median nerve injuries are not uncommon. The median nerve may be contused or torn by the lower end of the upper fragment in the extension fracture. Subsequently a median nerve so injured may be surrounded by scar, resulting in permanent damage unless a neurolysis or some appropriate operation is performed. Ischemic palsy is, however, primarily a muscle lesion, and the nerve lesions when associated with it are apt to be the result of a direct injury.

bilities for the development of a collateral circulation and good heart function.

There has been considerable discussion as to whether nerve injuries occur in

The mechanism of ischemic palsy should be understood in order that the symptoms

may be properly interpreted, and proper surgical procedures, prophylactic and active, instituted. Brooks, as a result of his experimental work, came to the conclusion that the classic picture of ischemic palsy could only be explained on the basis of acute venous obstruction. Clinical observations indicate the importance of venous obstruction as the etiological factor.

Induration of the antecubital fossa should be regarded as a danger signal. It indicates a hematoma or infiltration beneath the tense antecubital fascia, which seriously interferes with the venous return flow and the development of a collateral circulation. The importance of looking for this induration cannot be overemphasized, for its presence or absence may determine the procedure to be followed. The skin over the antecubital fossa is apt to be ecchymotic. It is usually tense and shiny. The radial pulse on the affected side may be normal, reduced in volume or absent. A careful examination should be made in all fractures of muscles, nerves and blood vessels. No fracture should be regarded simply as a fracture; but in all cases a careful examination should be made for associated injuries.

Severe spontaneous pain extending over the entire forearm in cases of supracondylar fracture is a symptom of importance and should demand attention. The pain is increased by pressure, and not infrequently an infiltration will be found in front of the wrist. The spontaneous pain is usually very severe, and, while it may not be so marked in some as in others, patients usually complain bitterly. The pain is felt especially about the antecubital fossa and along the veins. It is felt throughout the entire arm. The myositis with the infiltration has usually developed in greater part before the characteristic swelling and position of the fingers appear.

The muscles are swollen and indurated. The swelling and induration appear first in the bellies of the flexor group, then in the extensors, and then in the small muscles of the hand. The flexor muscles are first involved, probably, because of their nearness to the venous collecting trunks in the antecubital fossa. Swelling, cyanosis and oedema of the hand, especially on the dorsal surface, develop relatively slowly, for the myositic changes may be well developed when they appear. When the forearm is palpated, the indurated and swollen muscles will be felt. The fingers can be moved but little, if at all. When passive motion of the fingers is attempted, pain is felt. The fingers are usually flexed somewhat at the metacarpophalangeal and interphalangeal joints. They appear rigid and are swollen, seeming to project from a swollen palm.

The patient usually has a fever caused probably by the absorption of degenerated muscle. There may be a decided general reaction. Within two weeks, as a rule, the swelling subsides and the antecubital swelling and induration disappear; but the normal soft muscle belly is replaced by fibrous tissue, which, if the changes are extensive, may lead to the formation of hard fibrous masses or bands, sometimes of almost stony hardness, in place of the normal muscle bellies. The skin of the forearm, which during the active stage of the lesion was shiny, tense, cyanotic and swollen, and through which dilated veins might be seen, becomes thin, delicate and deprived of its subcutaneous fat. If an attempt is made to extend the hand the flexor tends to project as cords or bands, and the fingers are drawn into the palm of the hand.

The Position of the Hand and Fingers. The proximal phalanx is usually somewhat extended and the two distal phalanges are moderately or excessively flexed. Flexion of the two distal phalanges may be so marked that the nails are forced into the palm of the hand. The hand may be somewhat extended or in slight flexion. At times the thumb is not affected; while in other cases it is in rigid adduction. In some cases it is markedly flexed.

In most cases of ischemic palsy the changes are quite different from those

found in combined ulnar and median nerve palsy. In ischemic palsy when an attempt is made to extend the wrist, the fingers are forced into the palm. If an attempt is made to extend the fingers the hand is flexed. If one desires to extend the fingers the hand must first be flexed, a relative lengthening of the flexor tendons being attained in this way. This is one of the most certain tests of ischemic palsy, and there should be no doubt of the diagnosis for most of the cases are typical.

The following case indicates the onset of ischemic myositis:

This patient was a girl six years of age. This patient fell on the evening of Oct. 25, 1927 and injured her left arm. The injury proved to be a supracondylar fracture by extension. She was seen soon after the accident and it was then noted that her left forearm, wrist and hand were pale. At that time a radial pulse could not be felt. The fragments were manipulated and following this the radial pulse could be felt. Later under gas anesthesia a reduction under the fluoroscope was made. The reduction was easily made and the arm was then placed in flexion a little beyond a right angle. It was again noted that the radial pulse was not good, so the fragments were allowed to slip and once more the pulse became quite strong. Another attempt was made to reduce the fragments. After this reduction the pulse remained good and the color of the fingers quite normal. A posterior moulded splint was then applied with the forearm flexed at a little beyond 90°. Nothing was placed in the antecubital fossa in order to avoid pressure. The patient was watched for two and one-half hours. The circulation of the hand remained good and radial pulse appeared of normal size. The patient's parents were warned regarding the circulation and asked to return the next morning. The patient was brought back about eight o'clock the following morning, and at this time the hand was swollen, somewhat cyanotic and the fingers were partially flexed. The child could not move her fingers. The patient was admitted to the hospital.

The venous congestion, swelling and stiffness increased throughout the day. The patient suffered severe pain.

An operation was performed a little after seven o'clock on the day that the patient entered the hospital. After the patient was anesthetized a longitudinal incision was made from the lower part of the arm over the antecubital vessel into the forearm. When the skin was incised it separated widely because it was under tension. The incision was carried down through the fat and fascia over the antecubital fossa. Considerable blood had extravasated into the soft tissue, but no localized blood clot was found in the antecubital fossa. The incision was carried down between the muscles. The antecubital fascia was not sutured. The skin was close with some difficulty because of the tension. A posterior splint was applied, leaving the forearm in only very slight flexion. The dressings were applied loosely to avoid constriction. It was noted that at the end of the operation the rigidity and turgidity of the fingers were markedly improved.

A note made on October 29 stated that fingers remained of about the same color. Patient was unable to move them. Dressings were removed and some black silk sutures were removed. Several drops of serosanguineous material were removed. On November 23, 1927 the patient was discharged from the hospital with contractures of the fingers. Elastic traction, massage and baking have been carried on since, with marked improvement in the contracture and the use of the hand. I am quite certain that the incision of the antecubital fossa limited the extent of the myositis. The incision was made late, but the outcome is better than would have been expected at the stage of the development of the myositis when the incision was made.

The history of the following case would seem to indicate that we are dealing with a mild ischemic palsy in which no attempt was made to correct the ischemia even after it began to develop:

On July 25, 1928 this patient, aged five, fell from a fence and injured the left elbow. He was taken to a doctor who took the patient to the hospital. The next morning seven hours after the reduction, the arm being dressed in acute flexion, the hand and arm were considerably swollen. Nothing was done. The swelling gradually subsided. Blebs soon appeared on the fingers. When seen on January 26, 1929, the patient had a definite Volkmanns' contracture with induration of the flexor muscles. The contractures have been greatly

benefited by elastic traction and massage. The disability is greatly reduced.

The axiom that "an ounce of prevention is worth a pound of cure" can be no better applied in any way than to ischemic palsy. Easily prevented, the contractures are cured with difficulty. If in a supracondylar fracture, there is a marked displacement of fragments associated with injury to the soft parts and an infiltration and induration of the antecubital fossa, no cast or splint of any kind should be applied nor reduction by acute flexion attempted. While cast or acute flexion may not produce the myositis they are contributing factors to its development. An extension apparatus may be applied to prevent the over-riding of fragments, or the forearm may be allowed to remain in extension, no dressing being applied. With marked induration of the antecubital fossa no reduction should be made. The reduction can be made later. It should be remembered that what may be called a bad reduction may give good function, and poor reduction with good function is much to be preferred to perfect reduction with the disability of an ischemic palsy.

If the induration and swelling increases in the antecubital fossa, and cyanosis, weakness, oedema of the hand, immobility of the flexed fingers, and sensory disturbances appear, even if the painful subcubital infiltration is not great, operative interference must be considered. This consists of a longitudinal incision over the lower part of the arm extending through the antecubital fascia down into the fascia of the forearm. In some cases the tension will be so great that the skin cannot be sutured subsequently and it will have to be left open. Widely displaced fragments should be reduced when the operation is performed. Bardenheuer has used this procedure four times with marked success.

When the contracture has developed the prognosis depends entirely upon the amount of muscle that is left. If the contractile substance of the muscle has been replaced by fibrous tissue, no procedure will be of value. The disability is permanent, for there are no muscle fibers to function. Undoubtedly many mild cases of ischemic myositis recover completely. The resection of bones to produce a relative lengthening should be discarded. The results of tendon lengthening and transverse myotomy are disappointing. Gradual lengthening of muscles by elastic traction with the banjo splint, gentle massage, baking and other methods of physiotherapy give the best results providing that enough contractile substance remains, but in no case should passive motion be instituted which would be severe enough to cause hemorrhages in the muscle, for such hemorrhages would only be followed by the development of more fibrous tissue, increasing the contracture and disability.

Ischemic myositis develops after fracture even when no dressings have been applied. It develops as the result of an acute venous obstruction. Tight dressings or a constricting cast may determine the development of this myositis, if the conditions favoring it are already present. No attempt should be made at reduction of a supracondylar fracture when the antecubital fossa is infiltrated and indurated. If the cyanosis, swelling, and oedema of the hand associated with sensory disturbances, become more marked the antecubital fascia and fascia of the forearm should be incised to permit of the escape of the blood clot and infiltration in the antecubital fossa. The fragments may be adjusted at the same time. Elastic traction is the best method of treatment after the contracture is established. This may be combined with massage and other physiotherapy procedures.

SUSCEPTIBILITY TO CANCER*

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IT has been said that statistics can be made to tell anything, even the truth. The impressive statistics showing that cancer in the human species is increasing are at least open to question; reliable computations show that a greater number of people are living to reach middle or later age, at which time cancer is more common.

In countries that compile trustworthy statistics the incidence of cancer is approximately in the same ratio as to population and sex, but there is considerable divergence in the organs and tissues involved. About 30 per cent of the total deaths from cancer among women is due to cancer of the breast and genitalia. The genitalia of the male show a very low incidence of cancer. On the basis of cancer of the generative organs, therefore, one would expect the total incidence of cancer in men to be considerably lower than in women, but the percentage is approximately the same, because in men the organs common to both sexes, such as the stomach and the organs of the urinary system, are more frequently affected by cancer than in women, and this greater frequency is equal to the frequency with which the breast and uterus are the seat of cancer in women. The procreative organ (the testis) of the male is the primitive one from which the procreative organ (the ovary) of the female is derived, and the shorter life history of the female organs may perhaps make them less resistant to sources of chronic irritation than those of the male.

Cancer never develops in sound tissues. It has been assumed in the past that cancer is due to an external agency which enters into the human economy at the point of least resistance, such as a lesion caused by chronic irritation. New revelations would make it appear that cancer may be the result of agencies acting from within the body, due to biochemical dysfunction affecting the life history of embryonic cells. It is difficult to surmount the fact that when cancer has extended by metastasis to a new situation, it produces the histopathologic picture of the tissue in which it originated rather than that of the organ which becomes affected secondarily. If the disease were due to foreign invasion, it presumably would reproduce the type of cell of the newly invaded tissue rather than that of the primary seat of the tumor. In any event, it may be assumed that the agents which act on the cell to produce malignancy become an inseparable constituent of the cell, as metastasis in the human species takes place only by the transplantation of the malignant cell itself.

One factor of supreme importance which has not been sufficiently stressed is that individuals vary in their susceptibility to the cause or causes of cancer, whatever they may be. In no other way can we explain why 90 per cent of persons do not have cancerous disease, and why 10 per cent of them die from it. It is as logical to accept the hypothesis that the 90 per cent of persons have greater resistance to cancer than the 10 per cent, as to attempt to force an explanation of why only 10 per cent come in contact with hypothetic causative agents.

If the patient's susceptibility to the disease is the important factor in the development of cancer, the site of the growth would be determined by the tissue or organ subjected to the insult of a precancerous lesion, and the grade of malignancy and the metastatic possibilities by the susceptibilities of the body as a whole.

The most probable explanation would

be that when sources of chronic irritation exist, the attempt of the tissues involved is to heal the breach of continuity by normal cells, but when the irritation continues for a long time, the tissues become unable to develop normal cells for the purpose, and cells that are more and more immature are rushed to the rescue; in the susceptible individual the cells continue an unlimited functionless division. Certain sources of chronic irritation seem to have greater potentiality to produce malignant disease than others, as unrefined tar, which in susceptible animals seems to possess greater than ordinary powers of precancerous irritation. And as much can be said for sunburn cancer of the skin, sometimes called Australian disease, because of its frequency in certain areas of that country. And again, the betel-nut cancers of the mouth in the Philippine Islands are examples of ready response to certain forms of chronic local irritation.

Prolonged heat appears to have an increased power of causing chronic local irritation; possibly taking too hot food and liquids may have to do with cancer of the esophagus and stomach.

The local response of the tissue subjected to chronic irritation apparently is influenced by general systemic factors which may either accelerate or delay the development of cancer. The existence of such general factors was pointed out by Murray[1] in experiments in which he subjected mice to successive courses of tar painting. Murray stated that when a number of mice are subjected to tar painting, cancer will develop in a few of them after four months; in a larger number about the sixth month, and in some mice cancer will develop only after a much longer period of tar painting, eight, ten, or even twelve months. In a few instances cancer does not develop. It seems, therefore, that there are variations in the resistance, or conversely, in the susceptibility of individual mice to cancer from tar painting. Presumably, an animal thus susceptible, if subjected to a second course of tarring after the first tar cancer has been removed by surgical procedures, would develop a second cancer in response to this form of chronic irritation within approximately the same length of time. Murray found the opposite to be true; cancer failed to develop in the experimental mice in response to a second course of tarring. It is not necessary that the first cancer should be a cancer of the skin or that it should have resulted from tar painting. Mice suffer frequently from spontaneous cancer of the mamma, and such mice are particularly susceptible to the disease. Murray found that when such mice, after surgical removal of the cancer, were given a course of tar painting, it failed to result in the development of cancer.

The work of Slye[2] on the grafting of cancer in mice is fairly conclusive in this respect. Slye found that by breeding strains of mice in which the disease developed most readily, the susceptibility of these strains could be increased enormously, so that mice would be born with the disease. By mating mice that were not so readily susceptible to cancer, strains could be developed in which cancer could not be produced or transferred.

The work of Gye and Barnard, if confirmed by further experimentation, will greatly advance our knowledge of immunity to cancer. Gye was able to develop from the fowl sarcoma of Rous two complementary filtrates: filtrate 1, a particulate body which he believed to be a living organism, and filtrate 2, a non-particulate body which he called the "specific factor." He believed that the first filtrate contained a foreign microörganism, and that the second was an activating fluid. If the two were injected together into fowls, cancer was produced, but if the first filtrate was injected without the second, which we

[1] Susceptibility to cancer. (Editorial.) Lancet, 215: 1137–1138, 1928.

[2] Slye, M. Some observations in the nature of cancer. Preliminary report. Jour. Cancer Research, 11: 135–151, 1927.

might call the soil-changer, cancer would not develop. When the infectivity of a previously infective Rous cancer fluid (first and second filtrates combined) was reduced, as with chloroform, until it could not be transplanted, if more of the second filtrate was then added, cancer transplantation would follow. Gye's second observation was that he could substitute for the first filtrate of the Rous tumor a virus obtained from true malignant new growths of the mouse, of the rat, and of man, and that this substituted virus together with the specific factor, the second filtrate, from the Rous tumor would produce sarcoma in the fowl. Other investigators have not been able fully to confirm Gye's work.

Equally relevant was the work of other experimenters who found that while the Rous virus could be transplanted readily into experimental animals, if the tumor which resulted from the transplanted virus was subjected to the roentgen ray, the transplantation did not take place or disappeared if the neoplasm had obtained a foothold, and if the tissues were exposed to the roentgen ray before the virus was used, the graft would not take. They learned that the same virus, however, remained potent in spite of exposure to the roentgen ray and would produce cancer in other animals. Apparently the effect of roentgen ray had been to develop resistance in the individual which prevented transplantation and yet did not destroy the virulence of the virus.

All there is to cancer is contained within the malignant cell, and this cell has remarkable resemblance to the rapidly growing embryonic cells of the chorionic villi (Langhans' cells). It should be noted that Langhans' cells have extremely large nuclei and undergo the most rapid division of any normal cells in the body, but the nucleolus and the cytoplasm of the cell have 'no peculiarity of structure. The stroma of a cancerous growth is the measure of nature's resistance. The greater the amount of stroma and the less the propor-

tion of cells, the slower the growth. On the contrary, the greater the proportion of cells, the less their resemblance to the normal tissue involved, and the more rapid the growth.

Wilson, MacCarty and Broders have enlightened us greatly with regard to the histologic character of the cell in relation to malignancy.

Wilson was able, nearly twenty-five years ago, to develop an original polychrome methyl blue stain for frozen sections which gave good differential coloration of the various elements of the cell, thus making possible an immediate microscopic diagnosis. This method of examination of what might be called the "living" cell, because the examination takes place within two minutes after removal of the specimen at the operating table, tells the surgeon during the operation what the microscope sees in time to be of benefit to the patient, as contrasted with the celloidin or paraffin-fixed specimens with their artefacts, available at the end of four days to two weeks when it was too late to help the patient.

MacCarty called attention to the significant fact that the greater the proportion of the nucleus, and the less the differentiation of the cell cytoplasm the more rapid the growth of cells, as is normally seen in embryonic tissues. He went further, however, and showed that an excess of the nucleolar element within the nucleus is associated with the type of rapid growth and invasion which is clinically malignant.

Broders, in a careful clinicopathologic study of the relative amounts of cell differentiation in a tumor, pointed out that the more nearly the cancer cell approaches normal, the less the malignancy. In a long series of investigations he found that he could examine microscopic slides of cancerous tissue, and, without knowing anything of the history or the results of the operation, could classify the microscopic specimens into four clinical groups according to malignancy. An extensive follow-up study of patients operated on

for cancer has shown the accuracy of his prognostications. In the cases in Group 1, the disease, other things being equal, was essentially a benign process, with approximately 90 per cent of five-year cures from operation. In Group 2 there were 60 per cent of cures; in Group 3, 25 per cent, and in Group 4, 10 per cent. The results in Group 4 were so poor as to make serious surgical procedures of doubtful propriety, lest the immediate mortality be greater than the prospects of cure.

As an example, Broders' follow-up system showed that, contrary to general belief, the blacker a pigmented malignant growth, the less the malignancy, because the fully pigmented cells are more highly differentiated than the less pigmented cells. It is the function of the pigmented cell to produce pigment, and deep coloration is proof that this function is being performed. The value of these researches lies in their significance in showing that the greater the deviation in structure of the diseased cell from that of the normally functioning cell, the more malignant the process.

Bowing and Desjardins found from their experience with radium and roentgen ray that the more severe grades of cancer, Groups 3 and 4 of Broders' classification, may sometimes be made to take on the more favorable aspects of the cancers in Groups 1 and 2, with definite slowing of the process, so that sometimes such a case primarily inoperable may become operable. They point out that the sensitivity of the normal tissues of the part to roentgen ray and radium was the guide to the effect of these agents on malignant disease of the same tissues, and called attention especially to the extraordinary sensitivity of the lymphoid structures of the body. Desjardins found from experience that large malignant tumors of the lymphoid structures, so-called lymphosarcomas, would disappear so rapidly

under roentgen-ray treatment as from that point alone to indicate the pathologic nature of the growth.

The assumption has always been that the more severe grades of cancer are due to a more potent cause. I hardly need point out that these newer revelations throw some doubt on so ready an explanation. It is equally if not more probable that the more severe forms of cancer and the development of cancer in certain tissues are due to increased susceptibility. A good general resistance with a moderate local lack of resistance may favor the development of cancer of Grades 1 and 2 of Broders' classification, whereas lowered general resistance and greater local lack of resistance in certain tissues would lead to cancers of Grades 3 and 4 and to a more rapid metastatic extension to tissues in various parts of the body.

In 1926, in an address on the cancer problem which I gave before the Congress of the American College of Surgeons in Montreal, I made the following statement:

"The foregoing studies logically lead to the idea of increasing individual resistance to the disease and its ultimate prevention. Science has been able to develop soil-changers in smallpox, diphtheria, and tetanus. Why not in cancer? Because of natural immunity to the disease, relatively only a small proportion of the total population is susceptible to scarlet fever. With the Dick test the degree of natural immunity of the individual to scarlet fever can be determined, and if it is not sufficient to protect from the disease, it can be increased to normal by serum. Why not in cancer? Perhaps the development of cancer as well as its degree of malignancy is attributable to the diminished activity of immunizing processes rather than to the nature of the activating agent."

Observations since that time have confirmed the belief that I then expressed.

FIFTEEN YEARS WITH RADIUM IN THE TREATMENT OF FIBROIDS, NON-MALIGNANT BLEEDING & DYSMENORRHEA*

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THE value of radium in the treatment of *cervical cancer* is now well established, for except in England and in some of the German clinics, massive or selective irradiation has replaced the radical operation for cancer of the cervix, even in group 1 cases. This unanimity of opinion is based on five-year and seven-year follow-up records, which in many instances are nearly 100 per cent complete. However, in the treatment of non-malignant bleedings, fibromyomata, intrinsic dysmenorrhea and subinvolution of the uterus, the effect of irradiation is less certain, for while treatment by radium in a large proportion of properly selected cases has been followed by some miraculous cures, others having what has seemed to be a similar pathology have not yielded to the effect of the rays, though similar dosage and filtration have been employed.

The records from which this presentation is made cover fifteen years of radium therapy and give a very clear picture of our failures as well as our successes. Furthermore, they reveal the reasons for these failures, which for the most part have been errors of selection. This brings up the question; can selection be accurate, and what are the other factors which militate against success? The results herein reported have been obtained with 200 mg. of the radium element; emanations or the radium pack have not been employed; roentgen irradiation of the ovaries has occasionally supplemented the use of intrauterine capsules in large tumors. Our follow-up system, which is detailed, has given us the opportunity to see the results, modify and limit our indications and change the form of application.

Two factors determine the growth and development in all fibroid tumors, i.e. the location of the nodule and its relation to the uterine circulation; these, likewise, determine the life history and termination of every fibromyomatous growth. All fibroids, however, do not act the same when their blood supply is cut down or cut off. Furthermore, the blood supply is not the same in all portions of the tumor. This, in part, explains some of the variations and disappointments in our results, for any degree of edema affects the value of irradiation. With these facts accepted, we have undertaken this study in order that we may attempt to draw a few clean-cut deductions which may guide us in the future selection of cases for radium therapy.

Before it is possible to determine upon a plan of treatment in any uterine myoma, we must first appreciate:

1. How fibroid tumors develop and grow as well as how they live.

2. What associate conditions change the rate of their growth.

3. How and why they produce symptoms.

4. Finally; what pathological changes these tumor masses may undergo and to what dangers and complications these changes may lead. That all types of myomatous tumors are not amenable to radium or roentgen-ray treatment is generally conceded; but, likewise, all fibroid tumors do not require surgery and may need no treatment at all.

The fibroid tumor is the most common form of uterine neoplasm, and while histologically it is benign, it possesses great potentiality for harm by its growth, the attendant bleeding, pressure symptoms, circulatory and malignant changes. The last are evidenced by Fraenkel who found in a serial study of 1860 tumors removed

by operation, sarcomatous changes in 46. About half of these occurred in interstitial myomata and presented no clinical evidence of malignant change. The remaining half originated in the endometrium and the diagnosis was made by curettage and examination of the biopsy findings. Hence, it is evident that routine diagnostic curettage will not detect every sarcomatous growth; however, bleeding was a *constant symptom* in all of the sarcomatous tumors which originated in or near the endometrium.

The histogenesis of uterine fibroids is not definitely known. It is probable, however, that they develop from congenital rests or fetal misplacements of fibrous tissue in or about the wall of the blood vessels which course within the uterine muscle. When first recognized, these congenital rests appear as solid nodes which seem to be due to a proliferation of the muscular and connective-tissue elements in the myometrium around the different rest centers. They are usually found in the uterine body as small nodules, *in, but not of the muscle*, incapsulated and discreet. Our observations lead us to the belief that the hyperpituitary type of women who begins her menstrual life with an anteverted, anteflexed uterus with a relatively large uterine body, is prone to develop myomata. We have followed many women of this type for over twenty years and have watched them grow fibroids. Again, the subthyroid and subpituitary type with the anteflexed retroposited uterus and other symptoms of hypoplasia, the subjects of intrinsic dysmenorrhea, who are frequently sterile, often develop fibroids. On the other hand, women of perfect endocrinal balance seldom grow this type of tumor. Fibroids always produce a relative degree of sterility, either by imparing fertility or by favoring the early termination of conception by the production of abortion. Conversely we find that the uterus of the barren woman with endocrinal imbalance who menstruates thirteen times a year, is more prone to develop fibroids than the uterus which becomes frequently pregnant and is alternately passing through periods of hypertrophy and involution. In the last analysis, however, the sterility is not due to the fact that the uterus contains a fibroid or fibroids, but rather to *their location and their size.*

The growth and development of fibroid tumors as has already been stated depend: (1) on their relation to the uterine blood supply; (2) upon their location in the muscular walls. The great mass of the arterial and venous blood supply is found in the outer third of the uterine wall, and, as the pelvic and uterine vessels have no valves the blood is propelled through the sinuses of the uterine wall by muscular contraction. The basal endometrium and inner third of the uterine wall have a relatively poor supply, for the uterine arteries and veins which ascend toward the fundus on the lateral walls of the uterus give off the accurate vessels, veins and arteries which course anteriorly and posteriorly, while these in turn break up into the intermuscular branches which reach the basal endometrium as arterioles, actually terminating in the venous radicals from which the venous return begins. This paucity of endometrial circulation is one factor in the terminal necrosis which takes place in the overstretched endometrium covering submucous and polypoid tumors, and explains the metrorrhagia which is common in this form of growth.

The second physiological phenomena which determines the life, location and development of the fibroid is the constant intermittent contraction of the uterus, for every tumor mass is evolved in the direction of least resistance, carrying with it its capsule and circulation. These two factors are basic in determining the life and development of every tumor. It is only the intramural growth which is surrounded on all sides by an equal amount of uterine muscle that grows slowly and remains within the confines of the uterine wall. It is this type of tumor which atrophies at the menopause; likewise, it is

this type of tumor which is at some period of its growth amenable to radium and roentgen-ray therapy.

Menstrual bleeding is common in interstitial and sessile submucous growths, both of which increase the area of endometrial response, for any tumor which is extruded toward the uterine cavity or grows into it increases the area of endometrial surface, blocks the venous return and thus increases the duration and amount of the menstrual flow. *As long as the continuity of the endometrium is maintained, we have menstrual hemorrhage,* but as *soon as tissue necrosis occurs* in the overstretched atrophic endometrium, *intermenstrual bleeding* becomes a factor. It is, therefore, apparent that we must accurately determine the location and the relation of the tumor to the endometrial surface before radium or roentgen rays are selected for the cure of uterine bleeding.

Wh le it is admitted that diagnostic curettage should precede the introduction of radium in every case of endometrial bleeding, experience has taught us that the curette is not without danger; for in sessile submucous growths penetration of the capsule affords an avenue for infection, while in endometrial hypertrophy when curetting has been done, we have linear strips of retained endometrium between which are grooves opening lymphatics for bacterial invasion. Clinically, we have noted that when radium is introduced immediately following diagnostic curettage, the tissue reaction is much greater than when an interval of ten days or two weeks is allowed to elapse between taking the biopsy specimen and the introduction of the radium. Furthermore, it has been noted that there is less parametrial reaction when the radium is placed in the fundus above the internal os and kept there than when the capsules have had a cervical lie.

RADIUM IN MYOMATA

Radium will control the hemorrhage of uterine myomata and in a large number of cases will reduce the size of the tumor,

provided the tumor is intramural or submucous, *and not pedunculated.* Nevertheless, operation is still the procedure of choice for most myomata, for the indications for radium are limited and it has certain definite *disadvantages* such as:

First: While it controls bleeding and in the majority of cases reduces the size of the tumor, nodules outside of the uterus may be left without a blood supply and consequently are more likely to give trouble.

Second: Malignant complications already in the tumor may be overlooked for it has been shown that sarcoma is found in serial section in about 6 per cent of pedunculated submucous tumors. Consequently, we can lay down the dictum that radium is never permissible in submucous growths, unless a diagnostic curettage is possible, for while remarkable results have been shown following radiation of cervical cancer, body carcinoma is less likely to be permanently affected by the rays.

Third: About 54 per cent of all fibroids are complicated by some form of tubo-ovarian disease, consequently many of these complicating intrapelvic lesions are missed, and while the tumor is shrunk, and the hemorrhage controlled, the associated lesions keep up the patient's illness.

Fourth: Radiation when applied in sufficient dosage to check hemorrhage and shrink the tumor will seriously impair the reproductive functions in young women, and therefore should not be used as a procedure of choice in this class of cases.

Fifth: One group of the symptoms in fibroids which require treatment are those due to tumor pressure; here the effect of radium is too slow to relieve the effects which intraligamentous growths produce on the ureters and in blood vessels.

Sixth: The immediate effect of radium is the production of edema and the excitation of inflammatory reaction; hence, in the presence of old inflammatory adnexal lesions, this reaction becomes more marked.

Finally: Radiation will increase the necrosis in tumors which are already

necrotic, and by added acidosis increases the toxemia of the patient.

Against these disadvantages radium has certain definite advantages in the treatment of fibroid tumors, particularly if proper selection is made. These *advantages* are:

First: There is no operative mortality. There is no general anesthetic. There are few postoperative complications, and there is prompt control of uterine bleeding.

Second: Should radium fail, operation is always possible.

Third: The menopausal symptoms are not so marked.

Fourth: In intramural tumors we cannot only expect absolute cessation of the hemorrhage, but shrinking in the tumor in over 65 per cent of the growths.

Fifth: Radium is the procedure of choice in myomata complicated by heart disease, diabetes, chronic nephritis and in pronounced anemia for the temporary arrest of hemorrhage.

We have confined radiation in fibroids to those tumors which are not larger than a three-months' pregnancy, where the growth is definitely intramural and there are no subperitoneal nodules of any considerable size; and those submucous tumors which after careful examination under anesthesia are shown to be sessile. In all, we have treated 206 of these growths by radiation. In the same period over 700 fibroids have been removed by operation. These patients have had from 1800 to 2000 mg. hours of irradiation The radium element has been applied directly to the interior of the uterus in capsules in tandem, the alpha and beta rays have been excluded by proper filters using brass, aluminum, rubber and platinum of ½ to 1 mm. thickness. I have the follow-up records of all these cases and only 6 have needed subsequent operation. In these 6, all submucous tumors, the bleeding recurred and on operation it was found that the tumors had undergone a marked edema and necrosis. In 200 cases the bleeding ceased and has never recurred after the first menstruation, which was more profuse in a number of instances than some of the previous bleedings; this, in turn, was followed by a serosanguinous discharge which persisted for several weeks. In 136 of these tumors the growth has shrunken to less than half of the original size, and in 70 it has entirely disappeared.

SUBINVOLUTION, FIBROSIS UTERI, UTERINE INSUFFICIENCY

A large proportion of the patients who come to us for the relief of bleeding fall within the class of subinvolution. Fibrosis uteri is what is termed by some as uterine insufficiency, which vague term is used to designate a uterine condition in which there is severe menorrhagia without gross pathology to explain the cause of the abnormal bleeding. The uteri which we have removed for this condition, in the days when vaginal hysterectomy was popular, have shown a more or less constant pathology in the relative increase in the connective tissue over muscular tissue in the uterine wall. This tissue disproportion is characteristic of subinvolution or the uterus of repeated pregnancies and a common finding of the woman approaching the menopause. In this class my associates and I have applied radium therapy for the relief of bleeding in 260 women; we have never failed to check the hemorrhage temporarily, and in the majority of instances have controlled it for all time. Of these uteri 234 have atrophied and after a period of several months the characteristic symptoms of the menopause have appeared. Many of the cases in this group have been complicated by prolapse of the uterus in which cystocele was the predominating lesion. We have subsequently operated upon these women, interposing the atrophied uterus under the bladder with cure of the descensus. Clinical experience has taught us that it is good surgery to correct backward displacement before radium is applied; better drainage is thus secured.

MYOPATHIC HEMORRHAGES IN YOUNG GIRLS

Bleeding in this group is frequently excessive and is almost always due to endometrial hyperplasia; in fact the menorrhagia or metrorrhagia may be so excessive as to produce extreme secondary anemia. Some yield to the administration of pituitary extract, the regulation of the pelvic colon and cecum, intramuscular injections of sera and blood transfusion. When, however, this profuse bleeding is prolonged, the endometrium is usually hypertrophied and edematous and the uterus may be larger and softer; the cervix is soft with a velvety feel and the os is likely to be open with a halo of erosion about it. Not infrequently one or the other ovary shows palpable cystic enlargement. The blood studies of these cases have shown that the coagulation time and bleeding time have been within normal counts and the platelet count is similar to that found in secondary anemia due to bleeding. It was formerly common to curette these patients after all forms of internal medication had been tried and failed. Curettage is usually followed by temporary amenorrhea which lasts for a month or two; this, in turn, is followed by menorrhagia and metrorrhagia. This same case treated by radium for from 200 to 300 mg. hours, with the radium properly filtered with glass, silver, brass and rubber to cut out all of the alpha and beta rays, will establish normal menstruation after one seance. Only once have we had occasion to repeat the exposure. In this class 31 cases were treated. The average dosage was 250 mg. hours and but one application was given in 30 of this series. Our follow-up results have shown that the quantity of the menstruation as well as the duration was regulated in every instance except the one patient who required two intrauterine applications. The last of these was followed by an amenorrhea which lasted for one year when the menses were spontaneously established and have since recurred regularly. Six of these girls are now married and have become pregnant; three have been delivered of normal living children, a fact which answers some of the criticisms which have been made of using radium in young girls.

INTRINSIC DYSMENORRHEA

For years dysmenorrhea was classified as obstructive, congestive and neuralgic. Later other authorities gave it a uterine and ovarian origin, and still others attributed this distressing symptom to psychoneurosis. As we have come to have a better understanding of the physiological changes which make up the menstrual cycle, our conception of this disease has been materially revised.

Primary dysmenorrhea (intrinsic or essential) is usually part of the clinical picture of general hypoplasia. There is always a lesion, elusive as this may be, either in the endometrium or in the uterine wall. It is only by careful study of the sequence of symptoms that a conclusion can be arrived at. These uterine dysmenorrheas of the developmental type are commonly found in the anteflexed, retroposited uterus with defective cervical invagination and in the acute forward or backward flexions with fibroid rests. All parametrial or adnexal lesions must be excluded by examination under anesthesia. Cases of the first type have yielded to gradual dilatation of the cervix with Hegar sounds, and mild irradiation, while those with retrodeviations have had painless menstruation after the displacement has been corrected, the cervix dilated and radium applied. After the cervical canal is thoroughly dilated 50 mg. of radium properly filtered are introduced high in the uterine cavity and allowed to remain there for a period of four hours, a dosage of 200 mg. hours. This amount of irradiation does not stop menstruation, but for some unexplained reason, relieves the pain at succeeding menstrual periods. Thirty-six of such cases have been treated in our private clinic with absolute relief of their menstrual pain; 9 have subse-

quently become pregnant and 6 have been delivered of living children with no physical defects. Many of these women were invalided for two weeks out of every month and had previously been treated by dilatation, discission, electrolosis, the static current, diathermy, etc.; and 4 had been accustomed to taking large quantities of morphine for the relief of their pain.

CLIMACTERIC HEMORRHAGE (MENOPAUSAL BLEEDING)

Bleeding at the menopause should always be looked upon with suspicion, for the healthy woman with normal pelvic organs passes through this period without severe general or local disturbance.

Menorrhagia at the menopause is generally believed to be due to a deranged internal secretion which is a result of failing ovarian activity; likewise, it is explained that the hypertension, flushes, attacks of profuse perspiration, nervousness, irritability and depression are a result of the decreased ovarian secretion which allows an endocrine imbalance and invites increased adrenal function. Nevertheless, menorrhagia at this period demands investigation, for while endometrial hypoplasia is the common finding, the transition from endometrial hypoplasia to benign adenoma and then to adenoma malignum is an accepted possibility. In this series there were 3 such cases, women who in *two years time* passed through these pathological grades; fortunately they were under constant observation and their lives were saved by a timely hysterectomy. In others the uterine content is lacking, the endometrium is scant and atrophic, a condition found in 19 of this group. Women presenting histories of metrorrhagia should always be curetted, and the biopsy specimen examined microscopically before any plan of treatment is instituted.

We have been surprised since adopting the plan of routine curettage before introducing radium or employing the roentgen ray, to note how many of these bleedings are due to small submucous myomata,

or fibroid polypi. Thirty-three fall within this class. Cervical polyp was the pathology which caused the metrorrhagia that brought 20 of these women to the clinic. Three had retained decidual tissue, dating back many months; while in 18, the microscopic findings were adenoma; in 7 of these the bleeding recurred and the uterus was extirpated. In all 96 cases were treated in which the anatomic findings fell among the foregoing, and which because of the time of occurrence we have classed as menopausal bleedings. Ninety-four have been followed: in 87 the uterus is atrophied and there is no discharge; in 7 the bleeding recurred and the uterus was removed.

CERVICAL STRICTURE

This lesion is caused by placing the radium too low in the uterine canal or by the capsule being forced down toward the internal os by uterine contraction. It results in a constriction at the internal os, complete or relative, which interferes with uterine drainage and produces hematometra or pyometra, most frequently the latter. The symptom complex suggesting this complication consists of uterine colic simulating labor pains with sorensss and tenderness in both lower quadrants and over the hypogastrium, which is relieved by an intermittent discharge of blood or pus, or if this fortunate outcome fails to occur the uterine pain continues and on bimanual examination will reveal an enlarged fluctuant tumor in the location of the uterus. The blood sedimentation time is always low, though there may be no elevation in temperature or in the leucocyte count. Twelve of our cases have returned with this complaint. The treatment has been gradual dilation of the cervix with Hegar's sounds. This treatment should be repeated in two months, and where after thorough dilatation the purulent discharge persists, the uterine cavity should be obliterated with a chloride of zinc pack.

CONCLUSIONS

As our experience with radium has

increased our indications have become more and more limited and we believe that the follow-up study of this series justifies us in making the following deductions and suggesting the following contraindications:

1. Accuracy of diagnosis is essential and if there is doubt as to the diagnosis, operation is preferable to irradiation.

2. Highly neurotic or over-sexed individuals, or those with an unbalanced nervous system, should not be treated with radium, as irradiation produces atrophy of the vagina and cervix as well as atrophy of the ovaries, and is apt to accentuate all symptoms.

3. The occurrence of other intraabdominal lesions requiring surgery makes it wiser to operate on many pelvic tumors than to employ radium therapy.

4. Very rapid growth of a pelvic tumor suggests malignancy of the uterus or ovary, and complete extirpation is preferable to irradiation.

5. Degenerating pelvic tumors should be removed by operation.

6. Pressure symptoms from large fibroid growths of the uterus are most quickly relieved by hysterectomy as tumor shrinkage from irradiation is variable and uncertain and may never occur.

7. Pelvic inflammatory lesions may become activated by radium and cause peritonitis and death; hence, in the presence of these lesions operation is indicated.

8. Large pelvic tumors, pedunculated subserous fibroids and large submucous growths require hysterectomy, particularly so, if there is pressure on the bowel, ureter, bladder, or when metrorrhagia is the prominent symptom.

9. Radium has proved its usefulness in the treatment of menorrhagia in young girls and in intractable cases of dysmenorrhea without gross extrauterine lesion. The amount of radiation should never exceed 300 mg. hours. The treatment may be repeated if necessary.

10. For myomata in young girls or in child-bearing women under thirty-five years of age, myomectomy should be selected; while in multinodular growths with extensive involvement of the myometrium, subtotal hysterectomy with the retention of an ovary and tube should be the procedure of choice.

11. Extremely anemic patients or women in which the cachexia is out of proportion to the blood picture are bad radium risks. Operation gives the better results, but all such operations should be preceded by blood transfusions.

12. In cases with malformation, faulty position, or cervical tumors where uterine drainage is impaired, radium should not be used.

13. Parametrial exudative processes or adnexitis contraindicates the use of radium.

14. Finally, careless and indiscriminate use may produce far reaching damage. Where radium is indicated for benign gynecological conditions, the least amount of radium that will control the situation is the ideal.

THE CLINICAL COURSE OF
SUBACUTE YELLOW ATROPHY
AS OBSERVED IN TWO PROVEN CASES*

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FOLLOWING the first clinical description of acute yellow atrophy by Bright in 1836 and Rokitansky's studies of the pathology of the disease in 1842, cases have been recognized and autopsies reported. The studies of Marchand,[1] Meder,[2] Stroebe,[3] Barbacci,[4] and MacCallum[5] have added to the morbid anatomy of these lesions, but the several varieties of the acute degenerations of the liver and the etiological factors causing the lesions are still poorly understood. The fact that following certain of these acute degenerations areas of regenerated liver tissue are to be found in the scarred remains of the shrunken liver has been recognized by pathologists, and in a number of instances patients have been operated upon with the diagnosis of obstructive jaundice or acute or chronic cholecystitis with immediate or subsequent autopsy studies. The studies of the clinical course following such operations are very few and for this reason the 2 cases to be described are considered of sufficient interest to warrant their report. One of these patients has been studied for five months, the other for six years, after the onset of subacute yellow atrophy. Umber's[6] case, operated upon in 1919, is the only other instance of a follow-up report that the writer has found in the literature.

MacCallum[5] studied a case of a boy who had recovered from a severe illness "which may have been acute yellow atrophy" and six months later died of an acute infection. The liver was greatly reduced in size but contained a tumor-like mass in the right lobe, composed of dark green nodules like swollen liver lobules. Throughout the general liver substance every liver cell had been destroyed, the frame work had remained intact with the bile ducts and blood vessels, and from every bile duct sprouts were growing into the old frame work although nowhere producing definite liver cells. In the right lobe a portion of liver tissue had evidently been left intact, and this had become the tumor-like mass by the symmetrical enlargement of each remaining lobule. The mass which was finally the size of an orange must have been smaller at first and yet it sustained life and prevented any serious symptoms of hepatic insufficiency.

In the discussion of these pathological studies MacCallum concludes: "Where well-differentiated liver cells still persist, the new liver tissue is very simply produced by their mere multiplication by division and the less highly differentiated gall ducts take no part in the process but remain quiescent in their subordinate position as conductors of the secretion of the liver cells. Where, however, all the liver cells have been destroyed the epithelial cells of the gall ducts take upon themselves the more complicated process of production of liver tissue by first rapidly multiplying and then becoming differentiated, adopting the characteristics of the liver cells."

Pool and Bancroft[7] reported 2 cases with biopsy and autopsy findings showing the later stages of subacute yellow atrophy. One patient, a woman of twenty-one, had had symptoms of the disease for three and one-half to four months before operation, but preceded for a period of three years with symptoms suggesting chronic cholecystitis. She died twelve days after operation in coma.

The second case, a woman of sixty-four, had had a history of four months of digestive disturbances and asthenia. Five weeks before operation she began to have painless jaundice, followed in twelve days with severe right upper quadrant pain, obstinate constipation, constant nausea, and pronounced weakness with fainting spells. This patient did well for three days after the exploratory operation, but then became drowsy and died in coma. In both these patients the liver, at time of operation, was small with a sharp edge, the surface presenting circumscribed nodules of regenerated liver tissue elevated from the firm, degenerated liver tissue.

Umber[6] reported the first case of subacute yellow atrophy, explored during the convalescence from the disease, surviving operation and with a follow-up report of ten months. His patient, a girl of eighteen, developed painless jaundice with enlarged tender liver which later decreased in size under observation. She developed severe attacks of what was thought to be biliary colic, and an exploratory operation was performed two months after the onset of her first symptoms by Oberarzt Dr. Neupert. The liver was markedly decreased in size, but of the normal consistency, large and small nodules of regenerated liver tissue standing out above the surface of the connective tissue remains of degenerated liver. Gall bladder and ducts were not abnormal. The liver edge was sharp and above the rib margin.

CASE I. M. M. Unit Record #76301. Admitted to the Presbyterian Hospital on November 14, 1928. This is the first admission of a thirty-six-year-old Jewish housewife who came to the hospital complaining of jaundice of five weeks' duration.

Family History. The mother had had gallstones.

Past History. No accounts of severe illnesses, but the patient's general health had always been considered rather poor. She had suffered since puberty with indigestion, constipation, heart burn, distention after meals, and poor appetite. For a great many years she had complained of gaseous eructations after meals, associated with nausea and vomiting. These periods of indigestion were particularly severe during the menstrual period. Her menses began at fourteen and were always profuse. The patient had been married for fifteen years without pregnancies. A bilateral salpingectomy for pyosalpinx had been performed eleven years previously at another hospital.

Present Illness. About nine months before admission she had a severe attack of indigestion and became quite dizzy, complaining of great weakness. At this time she had severe midepigastric, cramp-like pain radiating in both directions across the epigastrium into the back and interscapular region. At the time she was said to have a trace of bile in the urine. Following this period she began to lose weight and strength. Five weeks before admission she had another attack somewhat similar, but less severe than the one nine months previously. Some time later jaundice was observed and traces of blood were noted in her vomitus. Stools were noted to be a light color and jaundice persisted increasingly. There were no further attacks of severe pain, but epigastric discomfort and pain between the shoulders persisted and jaundice remained the same, although her stools and vomitus contained bile.

Physical Examination. Temperature 99.4° F; pulse 78; respirations 20; blood pressure 115/75. The patient is a fairly well-developed and well-nourished woman showing a fairly deep jaundice of an orange hue. The significant findings were tenderness over the liver area, a spleen palpable 2 cm. below the costal margin, liver not palpable. Laboratory Findings: R.B.C. 4,600,000; Hgb. 75 per cent; W.B.C. 8,000; Polys. 78 per cent. The urine showed a trace of bile. Serum bilirubin 20 mg./100 c.c. Direct van den Bergh reaction positive. Blood Wassermann reaction negative. Both bleeding and clotting time were prolonged. The red cell fragility test was normal. The gastric test meal showed no free hydrochloric acid. The stool contained bile and was colored. The duodenal tube showed abundant bile. Amylase was diminished in the pancreatic juice. The liver function test with brom-sulphthalein showed a marked retention of the dye.

The patient was on the Medical Wards for a period of seventeen days, running an afebrile course, but continued to have pain and tenderness over the liver, continued jaundice and

"amine" breath. It was thought impossible to rule out an obstructive jaundice with chole-cystitis, but the writer, called in consultation, made the following note:

"I have maintained from the first time I saw this patient that the diagnosis is acute liver degeneration because of

1. The jaundice, beginning without pain, increasing without remissions.

2. Brown-colored stools with plenty of bile in stool and vomitus.

3. A liver decreasing in size; if it were an obstructive jaundice of this grade it should be enlarged up and down.

4. She has the deep orange tinted jaundice seen in acute degenerative lesions. A jaundice as deep as this I have never seen with bile showing in stools and vomitus where it was due to stone.

5. She has the amine breath which we have noted in almost all these acute degenerative lesions.

6. She has the nausea and anorexia of these cases.

Of course I am not certain enough of this diagnosis to rule out common-duct obstruction and have frankly discussed the uncertainty of an exploratory operation with the patient who accepts the hazard."

The *operation* was performed on December 2nd under local anesthesia with the following findings: The gall bladder, ducts and pancreas appeared normal. The liver was markedly diminished in size, had a somewhat uneven, irregular surface, although there was not noted the large nodules of elevated liver tissue, representing regenerated liver. The liver was somewhat firmer in consistency than normal and had a sharp liver edge in the parts examined. A section was removed which was reported as showing no remains of normal liver cells with areas of dense connective tissue containing remains of bile duct epithelium. Diagnosis: subacute yellow atrophy. (Fig. 1.)

This patient made a fairly good recovery after the operation, although her nausea and vomiting continued as did her jaundice. About a month after operation her jaundice, however, had markedly decreased. At this time, however she developed ascites for which paracentesis has been done three times. The patient left the hospital for two or three weeks, but returned because of increasing fluid and has been in the Medical Wards for the past

five weeks. The jaundice has almost cleared and her ascites has diminished so that she has not had any paracentesis for the past month.
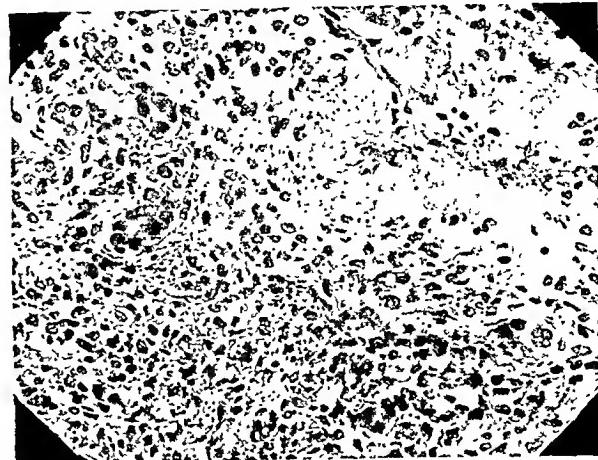
FIG. 1. S. P. 39217. M. M. Section of liver tissue removed four months after onset of subacute yellow atrophy showing no remains of liver cells, but some proliferation of bile ducts.

CASE II. B. H. Unit Record #56101. This patient, a thirty-three-year-old, unmarried, American stenographer, has been in the Presbyterian Hospital on five occasions. The essential features of her medical history and course are as follows:

She was well until the latter part of 1922 except for a severe attack of diphtheria when she was thirteen years of age. For about four months prior to her first admission in January, 1923 she had a poor appetite and lost 17 lbs. during the last month of that period. At the beginning of that month she had a bad cold which persisted. For about ten days before admission she was nauseated continuously and had a "heavy feeling in the stomach." She vomited occasionally and became very constipated. A week before entering the manifestations of jaundice appeared—dark urine and yellow skin, but no clay-colored stools. Examination at that time was essentially negative except for the jaundice and malaise with tenderness along the right costal margin which persisted and at times radiated around to the scapular region with a tender trapezius muscle. Catarrhal jaundice was suspected and also cholecystitis with "pancreatic asthenia," but other observations were made at that time which threw doubt upon these diagnoses: 1. The fact that she had felt poorly for four months before admission.

2. The presence of "amine" breath.

3. The rather striking rib tenderness.

4. The gastric intolerance apparently out of proportion to her general condition.
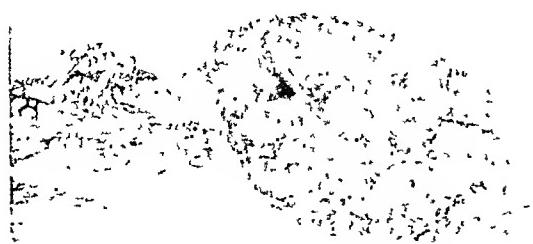
FIG. 2. S. P. 30051. B. II. Biopsy one year after onset of subacute yellow atrophy. Low power of a nodule of regenerated liver in an area of fibrotic tissue.

5. The fact that her stools were brown and contained bile in spite of the fact that her jaundice increased. She came in at the time when there was an epidemic of infectious jaundice.

She remained in the hospital two months. Her blood picture was normal, Wassermann reaction was negative, and she ran an afebrile course. Vomiting was a striking symptom and mental depression became a marked feature when the jaundice deepened. At times her mental apathy progressed almost to a coma. All the symptoms seemed to become accentuated during menstruation. The liver was not observed to increase but rather to decrease in size during this time. The tetrachlorphthalein test for liver function showed a distinctly abnormal retention of dye. The jaundice gradually faded, the attendant symptoms cleared up and she was allowed home.

She was admitted again just about a year later chiefly because of the persistence of pain in the right upper quadrant, along the costal margin without jaundice. Blood chemistry figures were normal but the liver function test still showed a marked dye retention. Exploration was thought to be justified and was done. The entire liver was found to be deformed as the result of marked changes in its structure: bands of pinkish colored connective tissue divided the liver surface into various shaped oval and circular islands of normal appearing liver tissue. Because of the shrinking of these bands the normal islands of liver tissue were pushed out, giving a disc or lenticular-like appearance to these islands. The gall bladder and ducts were essentially negative. The pathological report was as follows:

Gross Specimen. The specimen is a piece of liver edge 2 cm. long and with a disk-shaped nodule projecting from it measuring 1.2 cm.

FIG. 3. S. P. 30051. B. II. Biopsy taken one year after onset of subacute yellow atrophy. Section shows area of regenerated liver cells in an area of dense fibrosis.

in diameter and 5 mm. in thickness. On cut section the liver is of the usual color while the projecting nodule is much lighter, a pale brownish yellow, and seems much firmer in consistency.

Microscopic Examination. Sections were fixed in formalin and Zenker solution and stained with H & E, Van Gieson, Mallory's connective tissue stains and Scharlach R. They show the nodule which projects from the margin of the liver edge to be composed of masses of relatively normal-appearing liver cells. The architecture of the lobules seems to be well preserved and there is no definite fibrosis in this spot. The adjoining tissue is made up very largely of strands of connective tissue, enclosing many large and small bile ducts and blood vessels. Scattered through the connective tissue are a few isolated liver cells which seem relatively normal except for their isolation. There seems to be no fatty infiltration of the liver cells. There seems to be no demonstrable proliferation of bile capillaries in either part. The picture seems to fit into a lesion which has, at some previous time, destroyed a large part of the liver substance. The large nodule of liver tissue probably represents a compensatory hypertrophy following the destruction.

Diagnosis. Acute yellow atrophy of liver. (Figs. 2, 3.)

The recovery from operation was unevent-
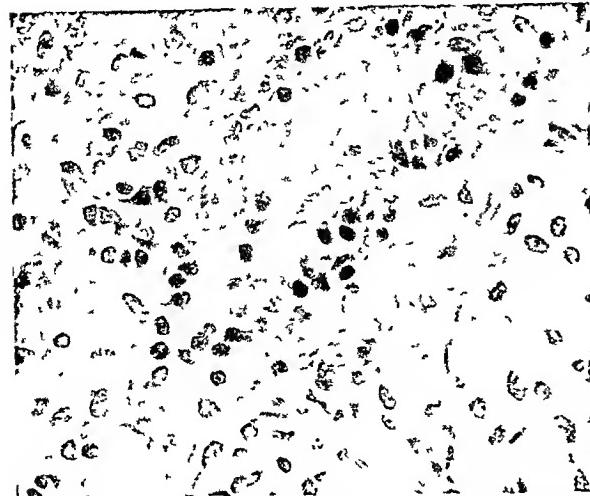
Fig. 4. S. P. 39970B B. H. Section of biopsy six years after onset of subacute yellow atrophy. Complete disappearance of all liver cells. Remains of bile duct.

ful surgically, but subsequently she complained of the old right upper quadrant pain. At intervals she had attacks characterized by (1) anorexia, nausea and vomiting, (2) pain and tenderness over the right lobe of the liver, (3) very obstinate constipation, (4) extremely foul breath with coated tongue, and (5) great mental depression and apathy. At times these attacks were so severe that she was thought to be going into cholemia. Then again there would be quite a dramatic remission and she would be apparently normal. She was discharged improved in three months.

Her third and fourth hospital admissions were the results of quite different episodes. She continued, at varying intervals, to have symptoms more or less as already described for about three and one-half years after operation, when she began to vomit blood in rather large amounts. She was admitted and her treatment on this occasion was largely to combat the effects produced by hemorrhage. It was successful and she returned to work. Nine months later a somewhat similar episode occurred without warning and she entered the hospital in shock from loss of blood. The most likely explanation appeared to be hemorrhage from esophageal varices. At the end of her stay she was slowly recovering from the loss of blood.

The patient was readmitted to the hospital on March 1, 1929 and was operated upon under

ethylene anesthesia, at which time an omentopexy with the inclusion of the mesentery of the large intestine in the posterior rectus sheath
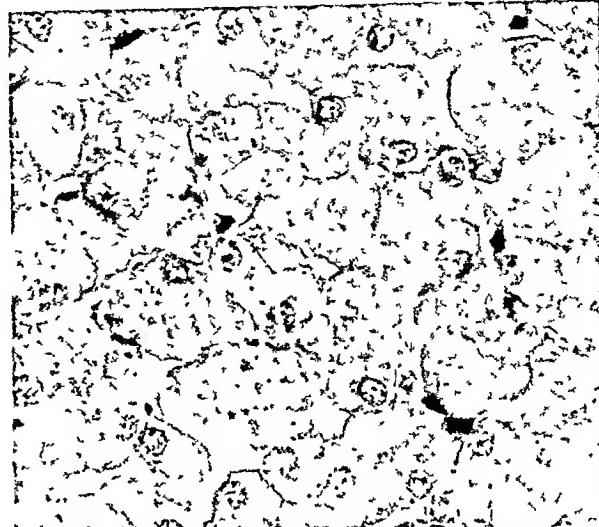
Fig. 5. S. P. 39970A. B. H. Section of biopsy six years after onset of subacute yellow atrophy. High power of regenerated liver cells. Vacuolated appearance of cells is probably due to glycogen.

was done because of a small atrophic omentum. The findings at the second operation in the liver were as follows:

There was the same remarkable picture in the liver of a regeneration following acute yellow atrophy, i.e. knob-like projections of normal appearing liver tissue, separated by yellowish pink bands of connective tissue, giving the appearance of islands of liver tissue rising above a sea of dense scar tissue. There was no free fluid in the peritoneum. The vessels in the mesentery and round ligament were moderately engorged. The omentum, unfortunately, was short and scanty which made it necessary to include a part of the gastrocolic omentum in the anterior abdominal wall. The gall bladder appeared normal and was not attached to the anterior abdominal wall.

Sections of liver tissue removed from the left lobe of the liver at this time were reported as follows:

Gross Specimen. Specimen consists of a small piece of liver tissue which is already in Zencker solution, so that the gross landmarks are difficult to interpret.

Microscopic Examination. On section, there are two distinct portions of the section. One consists of what is apparently regenerated liver tissue. The cells are somewhat variable in size and the cytoplasm is pale and distinctly granu-

lar, but the nuclei stain well and it is probable that the granular appearance of the cytoplasm presents some phase in the functional activity of the cells. The architecture of this portion is not like that of normal liver tissue. The lobulation is not distinct and there is a much greater distance between the portal areas than is usual. There is no distention of the canaliculi with bile. The other portion of the section shows an extremely fibrotic area dotted with round cells in which the remains of liver cells and of ducts may be seen. For the most part, the duct structures are old, but in one or two areas, ducts may be seen in which the lumen is not patent and where the cells are parallel to the long axis. Presumably these represent regenerated ducts. This is an exceptional finding.

Diagnosis. Regeneration of liver (following subacute yellow atrophy). (Figs. 4, 5.)

The patient made a very uneventful recovery, having far less postoperative nausea and vomiting than after the first operation. At the end of three weeks she was walking and had recovered her strength and vigor to an astonishing degree, and she was sent to a convalescent hospital where she, at the present time, is reported to be doing very well and is to return to her work in another ten days.

It is to be noted from the findings in the cases of Pool and Bancroft, in Umber's case, and in the 2 cases here described that the pathology in the living is quite different from that seen on the autopsy table several hours after death. In the living these livers are firm in consistency and have not the wrinkled, flabby, soft feel that is described in the autopsy reports. The nodules of regenerated liver tissue project abruptly above the surface of the degenerated liver, and the liver edge is sharp as noted in all of the operations.

These patients represent undoubtedly a subacute rather than an acute form of so-called yellow atrophy inasmuch as they did not go into the rapid cholemia and progressively fatal symptoms of the severe acute yellow atrophy. They may perhaps better be called cases of acute liver degeneration, but they represent a certain group of cases that offer difficult differential diagnoses from the cases of gallstone or pancreatic common-duct obstruction

in which surgery is indicated and effective. On the other hand there are certain differential points to be noted on careful observations in the history and physical and illustrated in both these cases, in Pool's and Bancroft's cases and in Umber's case, which make a fairly certain differential diagnosis:

1. The lack of typical biliary colic.
2. Severe anorexia, nausea and vomiting, obstinate constipation preceding a painless jaundice.
3. The presence of bile in stools and vomitus in jaundiced patients.
4. A deep orange tinted, rather than greenish, jaundice with bile-containing stools.
5. The presence of a peculiar pungent, fetid breath, termed by Loeb, of the Presbyterian Clinic, an "amine" breath and referred to by Umber as "fetor hepaticus."
6. The presence of a small liver, which may have been observed to be decreasing in size. In obstructive jaundice of any duration the liver increases in size.

Of course there will always arise the question as to whether gallstones or pancreatitis can be ruled out, and the onus of not ruling this out by an exploratory operation will have to be borne by the consulting surgeon called in by the medical advisor of the patient. The writer cannot see any great harm in proving the diagnosis by means of a small incision under local anesthesia, and in the cases reported the course of the disease has not been appreciably altered by such a simple procedure.

The subsequent clinical course of these patients is well illustrated in both of the cases here reported. With so much scarring of the liver portal obstruction is the logical late result. In the first case ascites has occurred and at the end of five months persists notwithstanding paracenteses. In the other patient the establishment of a collateral circulation has resulted in esophageal varices with two very severe gastric hemorrhages. In fact in both of these

patients an omentopexy to provide a possible shunting of portal blood became indicated and was carried out in the case of B. H. five years after the first operation and six years after the onset of her liver degeneration. The patient M. M. is considering the advisability of the operation.

This brings up the point of the advisability of doing an omentopexy if a severely scarred liver with areas of regeneration is found at the time of the exploratory celiotomy. The writer would be in favor of such a primary procedure if he should again encounter a similar case.

The study of these 2 cases has impressed us with the unfavorable prognosis in these cases of subacute yellow atrophy. Because of the liver damage remissions of liver dysfunction are almost certain to occur as well as portal obstruction. In the case of B. H. there have been several striking recurrences in the past six years of the syndrome of anorexia, nausea and vomiting, obstinate constipation, pain and tenderness over the liver, "amine" breath and great mental depression. The amazing feature of this case is the fact that she has made such remarkable recoveries from these remissions with what appears to be a return to astonishingly good states of health and working ability. For periods of eight to twenty-four months she has recovered and returned to her work at full efficiency. This as well as the remarkable picture which her liver has shown on the two occasions of her operations points to that marvelous power of regeneration in the liver and its unequalled factor of safety.

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LIPOMA OF THE STOMACH

REPORT OF A CASE*

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BENIGN growths of the stomach are not common as compared to other tumors of that organ. Eusterman and Senty have shown that less than 0.5 per cent of gastric neoplasms are benign. Balfour and Henderson reviewed all of the cases of benign tumors of the stomach that had been encountered at operation in The Mayo Clinic up to 1926; 58 cases were studied. The majority of these tumors were fibromas, myomas and fibro-adenomatous polyps. There were no lipomas in the series. Since this review there has been 1 case of gastric lipoma that has come to operation.

Lipoma is one of the most uncommon tumors of the stomach. In a thorough review of the literature we were able to find only 14 cases. Stetten, in 1909, reviewed the literature and compiled 77 cases of lipoma of the gastrointestinal tract. Of this number only 3 were in the stomach. The largest number were situated in the ileum and colon. He stated: "Lower down in the gastrointestinal tract the larger number of lipomas are found."

Ehrlich compiled from the literature 52 cases of gastrointestinal lipoma. Three were in the stomach, 6 in the duodenum, 6 in the jejunum, 9 in the ileum, 24 in the large bowel and 4 were indeterminate. His data corresponded closely to those of Stetten.

Borrman stated: "While lipomas of the intestine are not infrequent, in the stomach they are not often observed."

Virchow, in 1863, was the first to report a case of lipoma of the stomach. This was found at necropsy in a male; the age of the patient was not stated. The tumor was about 1 cm. in diameter, unilobular, situated on the posterior wall of the stomach, near the pylorus, and had arisen in the submucosa.

Murray, in 1888, reported a case in which he had found a lipoma of the stomach at necropsy. The patient was a man aged sixty-four years. There were no clinical symptoms that were referable to the growth. The tumor was situated in the submucosa, on the posterior wall of the stomach close to the lesser curvature and 5 cm. from the pylorus. The structure of the tumor was typical of the class to which it belonged.

Tilger found 2 lipomas of the stomach in 3500 necropsies. In both cases the neoplasm was situated in the submucosa near the pylorus and occurred in elderly persons. The exact age and the sex were not stated. The tumors were about 3 cm. in diameter.

Fischer, in 1905, cited a case, that of a woman aged thirty-seven years, in which he had encountered a fibrolipoma of the stomach in an operation for epigastric lesion. For one month prior to the operation the patient had had attacks of generalized dull abdominal pain occurring only during the day. Three days prior to exploration she had an attack characterized by severe pain of the kind described, localizing in the epigastrium. Vomiting was not associated; rest in bed and dieting were without benefit. At operation a hard red tumor was found on the anterior wall of the stomach, encroaching on the lesser curvature. It was about 3 cm. in diameter and projected somewhat from the wall of the stomach. The serosal covering was red and showed a number of dilated blood vessels. The tumor seemed to involve the entire thickness of the wall of the stomach. The growth with the adjacent inflamed

area was excised by removing a v-shaped segment from the anterior and posterior wall. The mucous membrane over the neoplasm was normal. The growth seemed to have originated from the muscular coat. The pathologic report was fibrolipoma with inflammatory changes and hemorrhage into its substance.

Bénaky reported a case, that of a man aged sixty-five years, in which there was found at necropsy a lipoma of the stomach 6 by 3.5 by 2 cm. in size and weighing 38 gm. It was oblong, flattened and slightly umbilicated, being attached to the posterior wall 1 cm. from the pyloric opening and completely obstructing it. The site of origin was in the submucosa. It was well encapsulated, easily enucleated and adherent only to the mucosa at the level of its central depression. Its color and consistence were characteristic of lipoma.

Hellström found at necropsy a submucous lipoma of the stomach in a man aged seventy-seven years. It was a flattened growth about 1 cm. in diameter and situated 7.8 cm. from the pylorus. There were no symptoms referable to the growth.

Nahmmacher described a gastric lipoma which was an incidental finding at necropsy in a woman aged sixty-five years who died of pneumonia. The growth was cylindrical, measured 8 by 3.5 by 3 cm., and was attached to the posterior wall very near the pylorus. The mucous membrane covering it was smooth except for a depression, 3 by 4 cm., over its proximal pole. Microscopically the tumor arose from the submucosa, the distal pole bordering directly on the pylorus but not producing obstruction to the latter. On section the tumor was composed of fatty tissue of a smooth golden-yellow color. The surface interposed between mucosa and musculature. The surrounding mucosa of the stomach did not show change.

Eliason and Wright found a gastric lipoma at necropsy in a man aged fifty-two years who died of pneumonia. It was situated in the submucosa of the fundus of the stomach. There were no symptoms referable to the growth.

Bianchi, in 1926, reported a lipoma of the stomach found at necropsy in a woman aged fifty-seven years. There was a history of dyspepsia and vomiting of a year's duration. The finding of a cirrhotic liver was probably the explanation of gastric symptoms rather than the lipoma. The tumor was situated in the submucosa near the pylorus. There was no ulceration of the mucosa. The structure of the growth was typical of a lipoma.

Spitzmüller presented a case of a man aged sixty-nine years with a history of intermittent diarrhea of one and a half years' duration and the passage of mucus and blood in the stools. Six months previous to operation an epigastric tumor was elicited. It was about 8 cm. in diameter, cylindrical, smooth, and moved with respiration. A roentgenogram showed an intragastric tumor of the stomach, probably carcinoma. Exploration revealed a dilated and hypertrophied stomach which contained a tumor, 20 by 27 cm., cylindrical, soft, elastic, yellow, grossly lobulated and sharply defined. It was attached to the posterior wall half way between the lesser and greater curvatures. The serosa over the tumor was normal; the mucosa was atrophied with two areas of ulceration. The adjacent mucosa was normal.

REPORT OF A CASE

The patient, a man aged fifty-nine years, came to the clinic in October, 1927, on account of stomach trouble. Five years previously he had had an initial attack manifested by a sense of epigastric emptiness and a gnawing sensation in the stomach. This was associated with the passage of several tarry stools. He was also weak, dyspneic and had palpitation on exertion. Following this he had four somewhat similar attacks. The fourth and most pronounced one occurred in December, 1926. Because of a severe hemorrhage from the bowel a transfusion was given at that time. He was confined to bed for six weeks. He recovered completely and felt well until the fifth and last attack which

occurred in August, 1927, at which time he was in bed for three weeks.

The general examination was essentially

FIG. 1. Tumor after removal, showing attached gastric mucosa.

negative except for moderate tenderness in the epigastrium. Urinalysis was negative. The hemoglobin was 70 per cent. Erythrocytes numbered 3,940,000. The gastric analysis showed the total acidity 68 per cent and free hydrochloric acid 50 per cent. The Wassermann reaction on the blood was negative. The roentgenologist reported a lesion on the posterior wall of the middle of the stomach, suspicious of early malignancy. A preoperative diagnosis of ulcer or benign tumor of the stomach was made.

At exploration a lipoma of the stomach was found. It was situated on the anterior wall about midway between the greater and lesser curvatures and 10 cm. from the pylorus. Gastrotomy was done and the part of the anterior wall containing the growth was excised. Other tumors or ulcers could not be demonstrated. The pylorus was open and the duodenum seemed to be normal. Exploration of the small bowel and colon was negative. The specimen, after removal, was an ovoid, smooth and well-encapsulated tumor, measuring 5.5 by 3.5 by 2.3 cm. in its greatest dimensions (Fig. 1). It was yellow, fat-like and slightly lobular. On one side there was an area of gastric mucosa 3 by 2.5 cm. In the center of this attached mucous membrane was an umbilicated area of erosion. Microscopically the chief constituent of the tumor was fat (Fig. 2). Apparently the tumor arose from the submucosa and involved it chiefly. There was a superficial erosion of the mucosa near the center of the attached membrane. The gastric lining at this point was reduced to

about a third of its thickness as compared to more distant areas. There was no sign of inflammatory reaction in the adjacent tissues.

FIG. 2. Section of tumor, shown in Figure 1, taken through the eroded area; fatty tumor may be seen under the muscularis mucosae.

COMMENT

Although lipomas are by no means rare in the submucous cellular tissue of the intestinal canal, they are rarely encountered in the stomach. As a rule gastric lipomas do not cause symptoms unless complicated by inflammatory changes, bleeding, ulceration or pyloric obstruction. The greater number of lipomas of the stomach that have been reported have been found at necropsy and have not given symptoms referable to the tumors.

Of the 14 cases compiled from the literature all but 2 were found at necropsy; of this number only 1 lipoma gave rise to symptoms. (See Table 1.) This was in Bénaky's case. The tumor was wedged in the pyloric opening, completely obstructing it. In the 2 cases in which the tumor was found at operation there were symptoms that well might be attributed to the lesion in the stomach. In only 8 cases were the age and sex stated, 5 males, and 3 females, between the ages of thirty-seven and seventy-seven (average sixty and three-fourths years). In 12 cases the tumor arose from the submucosa, in 1 case from the

TABLE I

DATA ON CASES REPORTED IN THE LITERATURE

Author	Date	Age	Sex	Found at necropsy	Size of lipoma	Layer	At pylorus	Body	Fundus	Curvature	Wall	Symptoms
						Site of lipoma						
Virchow	1863	..	M	+	About 1 by 1 cm.	Submucous	+	...	...	....	Posterior	
Murray	1888	64	M	+	....	Submucous	+	...	...	Lesser	Posterior	
Tilger		...	...	+	About 3 by 3 cm.	Submucous	+	...	...			
Tilger		...	...	+	About 3 by 3 cm.	Submucous	+					
Fenwick & Fenwick	1902	...	...	+	5 by 5.6 cm.	Submucous						
Fenwick & Fenwick	1902	...	...	+	About 2 by 2 cm.	Submucous						
Fischer	1905	37	F	*	About 3 by 3 cm.	Mucous	......	+?	...	Lesser	Anterior	Abdominal pain; vomiting
Bénaky	1905	65	M	+	6 by 3.5 by 2 cm. (weight 38 gm.)	Submucous				....	Posterior	Pyloric obstruction
Hellström	1906	77	M	+	About 1 by 1 cm.	Submucous	7 cm†					
Nahmmacher	....	65	F	+	8 by 3.5 by 3 cm.	Submucous	+	...	...	....	Posterior	
Eliason and Wright	1925	52	M	+	....	Submucous	......	...	+			
Bianchi	1926	57	F	+		Submucous	+					
Spitzmüller	1926	69	M	*	20 by 27 cm.	Submucous	......	...	...	Between lesser and greater	Posterior	Diarrhea; mucus and blood in stools
Borrman	1926	...	...	+	About 3 by 3 cm.	Subserous	......	+	...	Greater	Anterior	

* Found at operation.
† From pylorus.

subserosal layer, and in 1 case from the muscularis. In the cases in which the site of the lipoma was given, it was near the pylorus in 8 (1 being wedged in the pyloric opening), in the body of the stomach in 1 case and in the fundus in 1. Two were near the lesser curvature, 1 was near the greater curvature, and 1 was half way between the two curvatures. Five were on the posterior wall and 2 were on the anterior wall. The size of the tumor varied from about 1 cm. in diameter to 20 by 27 cm. Only 2 of the lesions were pedunculated. In 2 there was associated inflammation of the adjacent submucosa. In another case there was a defect of the mucosa covering the lipoma.

Lipomas of the stomach have the same characteristics as lipomas in general. They grow slowly and expansively, are lobulated, and are partially surrounded by the connective tissue in which they have developed. They vary from about 0.5 cm. in diameter to a weight of several grams; the color usually is that of normal fat.

The case herein reported is of unusual interest; for in spite of the fact that the tumor was small it gave rise to repeated and alarming gastric hemorrhages. The growth was well encapsulated and asso-

ciated inflammatory reaction was not present. The mucosa over the growth was normal except for a small area which was closely adherent to the tumor and umbilicated. No doubt this was in the area which had eroded, with the resultant hemorrhages. This eroding process had repeated itself with each hemorrhage and healing had taken place in the interim.

SUMMARY

Gastric lipomas are rare. Most of those that have been reported were found at necropsy. The usual site of growth is in the submucous layer of the stomach. As a rule they are symptomless unless complicated by inflammatory changes, ulceration, pyloric obstruction or bleeding. They may give rise to alarming hemorrhages, occult bleeding with secondary anemia, or pyloric obstruction.

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MALIGNANT TUMORS OF THE BLADDER & PROSTATE*

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IN tumors of the bladder, it is often difficult to say positively whether or not the case is malignant; in fact, we may consider that many cases of apparently benign papillomata of the bladder are potentially malignant, as we have all seen, in the days before fulguration was introduced, cases in which apparently simple papillomata eventually became malignant. Where a tumor is frankly infiltrating, little difficulty of diagnosis occurs, but where the tumor is of the papillary type, considerable difficulty may be experienced, and even when a section is removed, the outer portions of the tumor may show little evidence of malignancy. The pedicle and base are the most important parts to study microscopically, and these may be difficult to excise with the small cystoscopic forceps which are usually employed. It has been our practice for a number of years to use the cystoscopic rongeur, with which much larger pieces of tissue are obtainable, and where a positive diagnosis is very desirable, one should attempt to obtain a portion of tumor near the bladder wall to exclude malignancy in that region.

The operative indications depend much on the location of the tumor. Where one is certain that the disease is malignant, and particularly where it is infiltrating, or a definite carcinoma of the bladder, there can be no doubt, in our opinion, as to the great value of resection. This should be as thorough as possible, and if the tumor is situated in a portion of bladder covered by peritoneum, we think this should be excised with all the coats of the bladder wall. In such cases it is necessary to go into the abdomen, but we have recently shown that it is quite possible to excise the peritoneum with a large area of bladder wall without doing a previous laparotomy. One may penetrate through all coats, including the peritoneum, from an intravesical exposure, and without danger of injuring the intestines, and no difficulty is experienced in closing first the peritoneum and then other coats of the bladder through the intravesical wound. If the tumor is located on the anterior, lateral or posterior walls of the bladder, and especially if at the vertex, it is our opinion that in invasive carcinoma of the bladder, radical resection should be carried out. Unfortunately, the large majority of vesical tumors are located in the region of the trigone or closely adjacent to the ureteral or urethral orifices, and surgical extirpation becomes not only more difficult but far harder to make radical, owing to the inability to do as wide resections as in the upper portions of the bladder.

The results in infiltrating carcinoma of the base of the bladder are far from satisfactory. The immediate mortality is fairly high, and the percentage of recurrence is very large. In some cases the necessity of transplanting the ureter has brought on serious complications. After trying various methods of operative technique for carcinomata of the base, we have come to rely largely on the implantation of radium through a suprapubic wound, after excision of the intravesically projecting portion of the tumor by means of cautery. A study of 72 cases, in which suprapubic resection of the bladder was carried out, shows that 33 are already dead from recurrence, and in 3 there has been recurrence, though these patients are still alive at the end of a year. Four patients are dead from other causes, in some of which there may have

been recurrence. Six cases have been lost sight of. Twenty-two patients are either free from symptoms, or are well on cysto-

FIG. 1. Charting of radium applications: *a*, intravesically, with Young's cytoscopic applicator; *b*, by rectum, with Young's simple rectal applicator.

scopic examination. Two have shown recurrences on cystoscopic examination, but these recurrences have disappeared by endovesical treatment, fulguration and radium. Twelve patients are apparently well after an interval of four years since operation. Most of these are cases of tumor of the vertex, anterior, lateral, or upper posterior wall of the bladder, and it is doubtful whether we have a single case of a tumor in the trigonal region cured by resection alone.

In the treatment of papillary tumors of the bladder, we have found high frequency

electrical applications (fulguration or electrocoagulation) of the greatest value. Where the disease is benign and not very
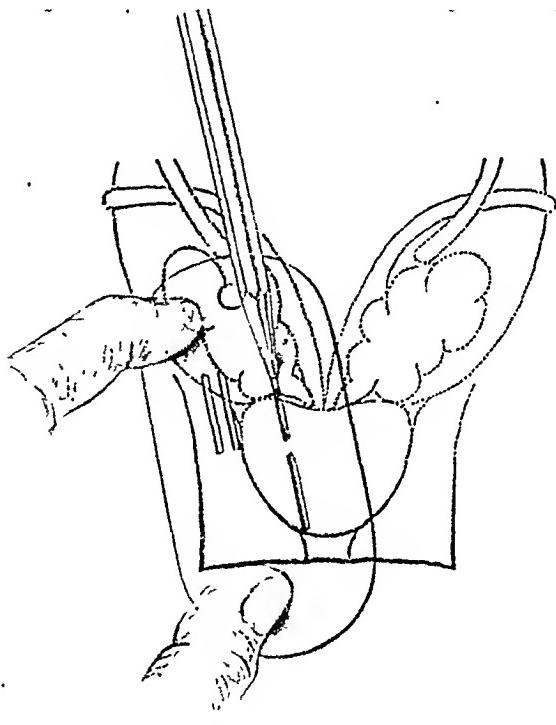
FIG. 2. Use of celluloid marker. Tandem tube radium applicator employed over left lobe of prostate.

extensive, a very rapid destruction and complete disappearance of intravesical papillary tumors is secured. Even when benign, a larger papilloma can be made to disappear very much more rapidly by the applications of radium in addition to fulguration; in fact, it is our practice to apply radium with my cystoscopic applicator in practically all cases of vesical papillomata, even where small or benign. Not only is the disappearance of the tumor greatly facilitated, but we consider it very important to have this application of radium to the pedicle and base of the tumor, as it is here that one fears eventual malignancy, and the use of radium may be looked upon as a preventive.

In malignant papilloma, the use of radium applied through the cystoscope is of very great importance, although we usually alternate with fulguration, as we find that such combined treatment usually

greatly hastens the disappearance of the tumor. We have now followed 64 cases of malignant papillomata which have been

the bladder without more overlapping than is desired. Cystoscopic burns of other parts of the bladder are thus prevented,
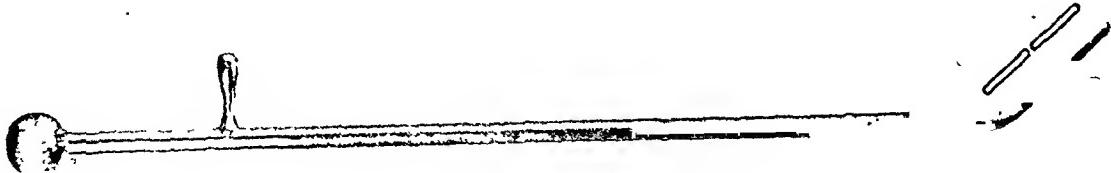
FIG. 3. Radium applicator carrying one or two tubes of radium (100 mg. each) in platinum tubes, beak being composed of silver surrounded by gutta-percha. Note fixation ball externally.

treated by radium applied cystoscopically and by fulguration. Nineteen of these cases are free from recurrence on cystoscopic examination, and 14 patients who could not return say that they are free from symptoms now, three to ten years since treatment was completed. Four patients who had recurrence were given a second course of treatment, and are well now after periods of two, three and ten years. Six patients with recurrences were improved, and 4 patients died of recurrence. Eight patients are dead, apparently from other causes. Since a good many of these 64 cases were very extensive in character, and far beyond any possibility of resection, the results obtained in many of these cases have been indeed quite brilliant.

After an experience of about ten years with the endovesical cystoscopic application of radium, we are more than ever convinced of its great value. We employ two platinum tubes, of 100 mgh. each, which are usually placed side by side in the beak of Young's cystoscopic applicator. When the radium has been applied deeply against the tumor mass in a site selected by cystoscopic guidance, it is held there by fixation to the table, by means of a clamp. This clamp, which grasps the ball on the outer portion of the radium-bearing sheath, makes it possible to hold the radium in situ for a considerable period of time, generally an hour. In this way accurate applications are made to different portions of the tumor or other sites in

and the whole area of tumor invasion is completely covered. Such cases are charted, as shown in Figures 1 and 2. If the tumor lies on the base of the bladder, the trigone or vesical neck, it can be reached from the rectum, the applications being made by my simple rectal and urethral applicator (Fig. 3), without the aid of the cystoscope, which is unnecessary in such cases. In this way tumors of the bladder may be subjected to a cross fire of radium which makes it possible to give them a considerable number of radium hours of treatment. As already remarked, not infrequently very extensive tumors disappear with surprising rapidity.

When the tumor is at the vesical neck, urethral applications may be of very distinct value and may include, not only the prostatic urethra, but the vesical orifice and the trigone and adjacent parts of the bladder wall. Such treatments are given under local anesthesia (4 per cent procaine in urethra and bladder), assisted, if necessary, with morphia, although caudal anesthesia may be employed very successfully in irritable cases. We usually employ Young's cystoscopic applicator No. 1, in which the radium is carried in the oblique beak of the instrument. Where the tumors are more distant from the central portion of the bladder, far out on the lateral or anterior walls, instrument No. 2, in which the radium is carried by a parallelogram mechanism (Fig. 4) out to a point about 3 cm. away from the cystoscope, may be more appropriate. For other positions in

the bladder, we sometimes employ instruments 3 or 4, by which the radium is carried in a position transverse to the

viously encountered in the use of the bare tubes. Where deeper structures, particularly around the prostatic orifice, are
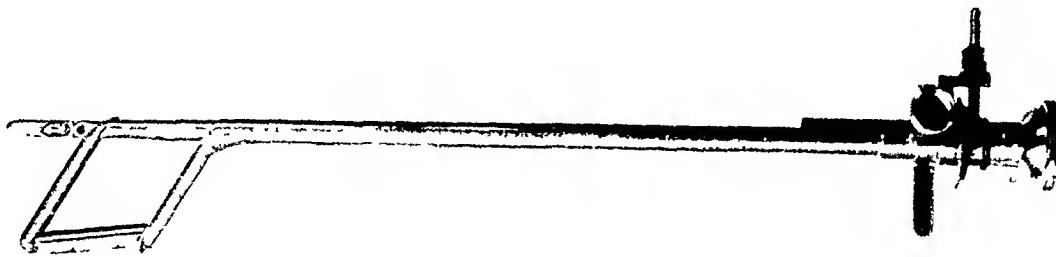
FIG. 4. Young's parallelogram cystoscopic radium applicator carrying 200 mg. radium in capsule.

cystoscope. By means of these various instruments it is possible to apply radium in considerable quantity to the bladder, and to hold it accurately in place for long periods of time, and thus obtain a large number of milligram hours of direct radiation. This technique is so effective that we usually employ it to the exclusion of suprapubic insertion of radium through open operations, and with results which are very satisfactory.

In certain tumors of the base of the bladder, however, we are convinced that a suprapubic exposure with cautery resection of the endovesically projecting papillary outgrowth is preferable to the endovesical cystoscopic treatment. After using various types of technique, we believe that after removal of the intravesical portion flush with the bladder, the best method is to insert screened radium, either element or emanations, through the area of the base, and into the adjacent bladder wall, covering an area 1 cm. wide around the tumor, and leaving in place radium equivalent to 1 mg. per cubic centimeter of tissue. It is wise to use points containing no more than 1 mg., and it is probable that ½ or ⅓ mg., applied with correspondingly greater frequency, is even preferable to milligram doses. The bare glass tubes are undoubtedly not as satisfactory as the screened radium; since employing the latter we have rarely seen the extensive sloughs which were pre-

invaded, one may insert screened needles to a greater depth, and these needles may contain 10 or 12 mg. radium element.

For the purpose of these endovesical treatments, we have on hand 20 platinum needles, each containing 1 mg. radium element, and provided with a stout silk ligature with which to withdraw them, and in addition, three needles with handles attached, of 10 mg. each, and two of 12½ mg. each. We have usually found this armamentarium sufficient completely to encompass and infiltrate with radium any tumor masses that we have attacked through this suprapubic technique.

Our opinion is that tumors of the trigone which are apt to involve the deeper structures (seminal vesicles, ampullae, perirectal and retrovesical tissues) can be more radically attacked by the deep insertion of radium than is possible by the so-called radical resection which does not usually include these deeper structures. When we consider that there is very little mortality attending such methods with radium, whereas one suprapubic resectionist admitted a few years ago a mortality of over 30 per cent, the danger of the so-called hemisection in such cases is evident, and statistics are not yet forthcoming to show that the results obtained are superior. The great difficulty in arriving at the truth is the absence of thoroughly reliable, completely studied and well followed-up cases, and until such

are furnished, one cannot state accurately what can be accomplished by means of the very radical or extensive operations which have been recommended in malignant tumors of the base of the bladder.

Thirty-eight cases of papillary carcinoma were treated in our clinic by fulguration and by cystoscopic application of radium. It has been difficult to follow all these cases, but we are convinced from subsequent cystoscopic studies that 18 are well for periods up to ten years. It is believed that there are many more cases which are free from symptoms, as we would surely have been apprised, had there been recurrence in some of these cases; but here again the difficulty of knowing the exact truth is apparent.

In conclusion, we believe in radical resection of infiltrating malignant tumors of the bladder where this can be done safely, as in the case of tumors of the anterior, lateral and posterior walls and vertex of the bladder; that in such cases complete mobilization of the bladder, and so-called delivery externally, is not only unnecessary but inadvisable, in that it does not permit of radical resection of the adjacent peritoneal covering in tumors of the vertex and posterior wall. Another objection to stripping the bladder off from adjacent tissues is that important arteries supplying most of the bladder are severed and such vascular supply is important after operation. When extirpation of the deep lateral or posterior parts of the bladder is indicated, unilateral mobilization may be of great assistance; and, in fact, necessary for a complete operation; but owing to the proximity of other organs, (seminal vesicles, etc.) which are not removed by such operative resection, and their frequent invasion by carcinoma, the question arises as to whether such cases are not best treated by implantations of radium, as already stated. Time alone and much more careful study of cases than has heretofore been furnished will be necessary to settle some of these problems.

In considering these brief remarks, it seems just to say that since the introduction of endovesical methods of diagnosis and treatment, and the application of radium in the treatment of vesical tumors, great progress has been made. Fulguration has itself been one of the most important innovations in surgical history, but of equal importance and of more far-reaching effect is the endovesical use of radium. But with a combination of these methods, radical curves have been obtained which were heretofore impossible by surgical methods.

MALIGNANT DISEASE OF THE PROSTATE

Statistics of our clinic and several others, where large numbers of prostate cases are seen, show that about 20 per cent of the elderly men patients requiring treatment for obstructive conditions of the prostate had carcinoma. In one-half of the cases in our series, hypertrophy of the prostate was also present and this may obscure the diagnosis. On rectal examination in such cases, even though the posterior layer may be quite hard, the elastic hypertrophied lobes beyond may impart a sense of elasticity which may be deceptive. It is here that palpation of the suburethral portion of the prostate upon a cystoscope in the urethra is of great value, and when one finds marked increase in thickness and induration of the whole suburethral portion of the urethra, particularly that below the verumontanum, one may be very suspicious of carcinoma. An area of very great induration, even though it may appear encapsulated and confined to a small portion of the prostate, should be suspected. In some cases it may be a phlebolith, in others, a definite prostatic stone, in others, a very fibrous localized nodule of hypertrophy. The roentgen ray will demonstrate whether the indurated nodule is a phelbolith or calculus, but if one is still suspicious, exposure through the perineum to get direct palpation and if necessary, excision of the nodule for microscopic examination of the frozen section, are highly desirable. It is inadvisable to

wait and watch such cases, and although we have seen 1 case in which the growth was extremely slow, and at the end of
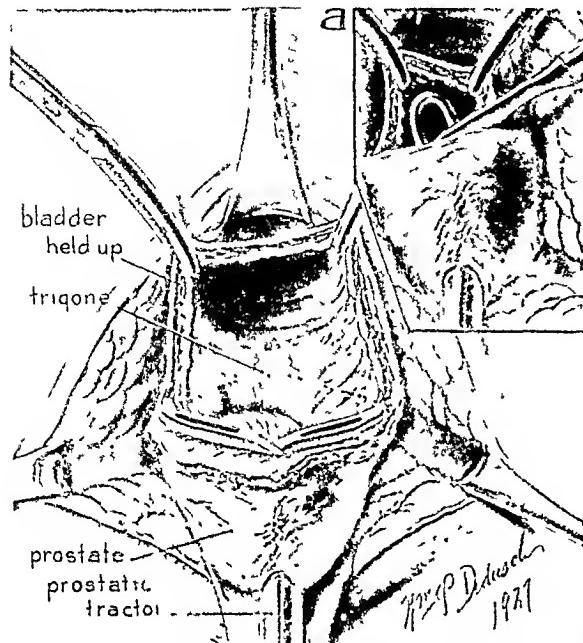
FIG. 5. Radical operation. a. Wound in bladder being enlarged on each side with scalpel. Incision runs close to vesicoprostatic juncture. Floor of bladder then exposed; trigone, ureters and median lobe of prostate then seen. Trigone cut across at point indicated by dotted line.

two years was only slightly larger than when we first saw it, valuable time may be lost and metastases may occur. We are more than ever convinced that the radical operation for carcinoma of the prostate is indicated wherever the condition is at all favorable, that is when the disease is still within the capsule of the prostate, has not involved the membranous urethra, only extends a short distance into one or both seminal vesicles, and is not accompanied by glandular or other metastases. This radical operation is not very difficult. The capsule of the prostate, with the neck of the bladder, a large part of the trigone, seminal vesicles and the ampullae of the vasa deferentia should be removed in one piece (Fig. 5). The anastomosis required to close the defect is one of the easiest parts of the operation (Fig. 6) and remarkably successful in that in almost all cases a prompt and permanent healing

is obtained, and without the formation of stricture. In fact, in 27 cases we have never seen definite stricture form at the
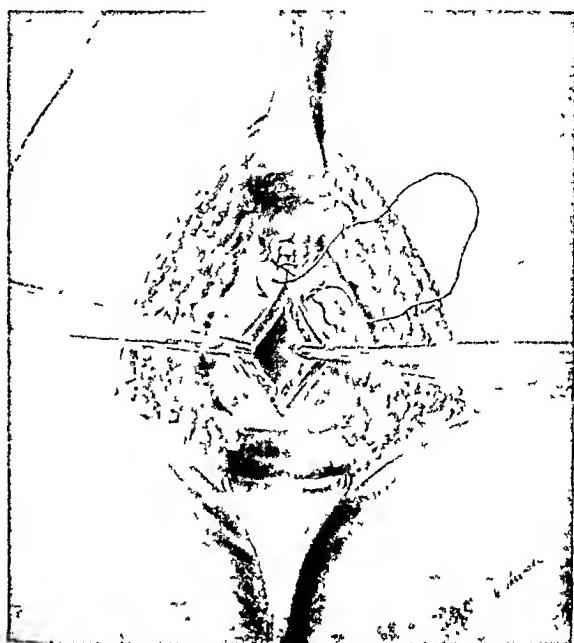
FIG. 6. Closure of remainder of vesical incision longitudinally, with continuous suture.

site of anastomosis, and they have not required the passage of sounds. Our first operations were followed by incontinence, but since adopting a special technique, by which we have endeavored not to penetrate but stay behind the transverse anterior prostatic fascia, the important arteries, veins and nerves supplying the triangular ligament and external sphincter have been avoided, and complete urinary control has been secured. It is an interesting fact, and rather surprising to physiologists, that it is possible to have perfectly normal urination with intervals of from five to seven hours in cases where the entire prostate, with internal vesical sphincter and adjacent trigone, has been removed.

The results obtained by this operation may be summarized as follows: There was only 1 operative death in 27 cases. This patient died of shock a few hours after the operation, and autopsy showed an extensive intraperitoneal mass of carcinoma which had not even been suspected.

One patient died of recurrence eighteen months after the operation, and 2 died about two years after the operation.
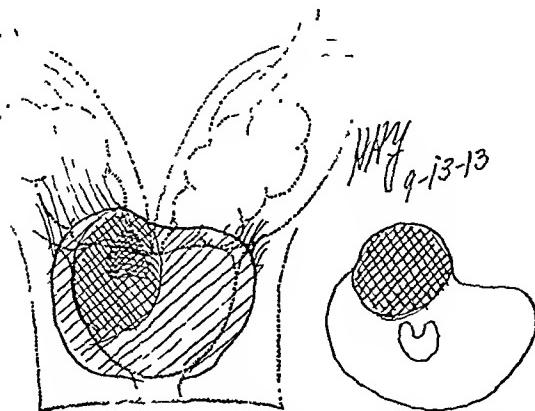
FIG. 7. Prostatic chart in Case VIII. Diagram made of prostatic examination showing hard lobule in left lobe. Radical operation September, 1913. Patient lived eight and one-half years, no evidence of recurrence.

Of these, 1 died suddenly of heart disease, and autopsy showed no recurrence; the other died from some unknown cause, but his physician thought no recurrence was present. Two patients lived three years, and died of recurrence. Five patients have been operated on within the last two years. All are apparently well, but it is much too early to speak of ultimate results. Eight are alive and apparently well for periods varying from three to thirteen years after the operation, 1 three years, 1 three and one-half years, 1 four years, 1 six years, 2 seven years, and 2 thirteen years. Some of these operated on by the most recent technique have normal urination, and one patient does not arise at all at night to urinate. Fifty-seven per cent of the patients operated upon seven years or more ago, have lived for periods of from seven to thirteen years without recurrence. The rectal findings in 3 of these cases treated by my radical operation are shown in Figures 7, 8 and 9. Three deaths have occurred from complications not due to malignancy. Seventy-two per cent of the patients have lived over a period of from seven to thirteen years since leaving the hospital without recurrence. Some of the cases were too far advanced for the radical operation, and it should not have been attempted. With improved methods, more careful work and
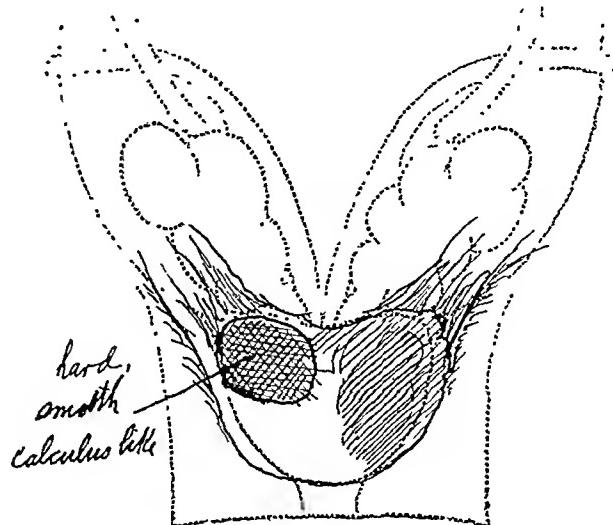
FIG. 8. Chart of rectal examination in Case XI. Radical operation April, 1914. Pathological report: carcinoma. Letter, October, 1927, thirteen years after operation, reported patient well, urination normal.

earlier diagnoses, this radical operation for carcinoma of the prostate should rank high for cures among the surgical operations for carcinoma. One of the most gratifying factors is the fact that many of these patients have had no incontinence,
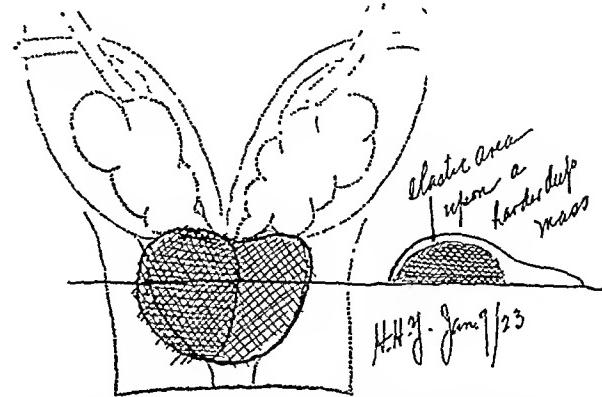
FIG. 9. Rectal chart in Case XX. Carcinoma confined to left lobe. Confirmed microscopically. Alive and well nearly six years later.

although the entire prostate, median and internal sphincters and most of the trigone have been removed.

Implantation of Radium by Operation, with the Hope of Cure. We have used this method both through perineal and

suprapubic wounds, but without a single complete success. It certainly is not to be considered as a radical cure, and it is,

prostate can be treated by cross fire methods from the rectum, urethra and trigone, and in some cases remarkably
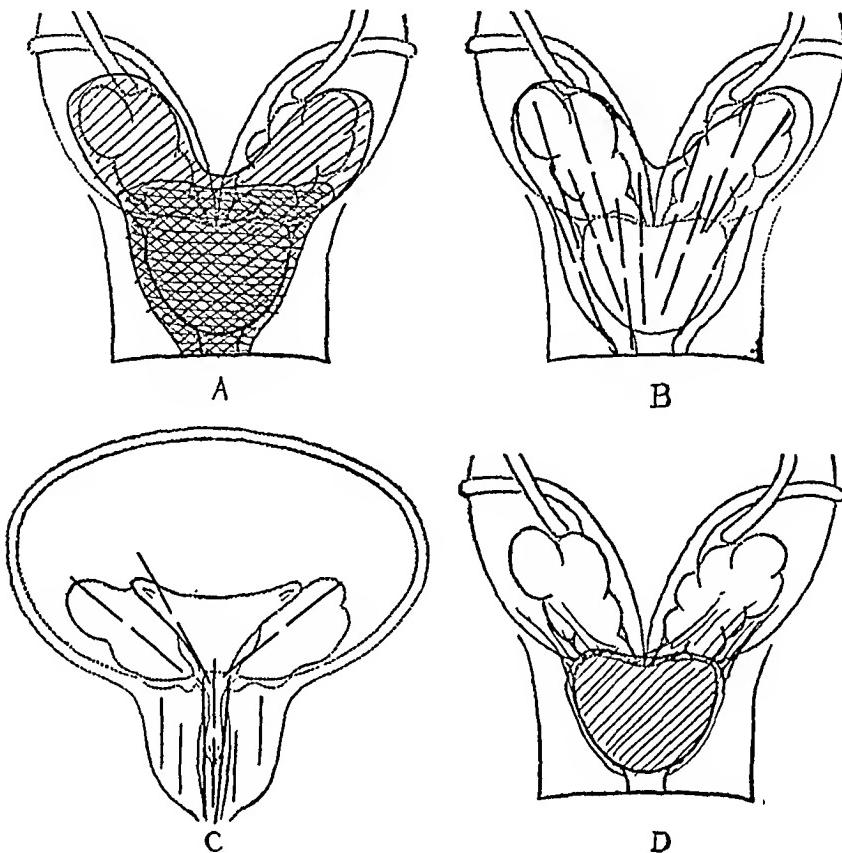
FIG. 10. Prostatic chart of case of carcinoma of prostate and lower portions of vesicles treated by radium. Treatment by radium applied: a, through rectum; b, through urethra and bladder, and c, by puncture through perineum. d, Marked decrease in size of prostate four months later as result of treatment.

I believe, inferior to other operative methods.

The Treatment of Carcinoma of the Prostate by Radium Applied through the Rectum and Urethra. In 1913 Pasteau and deGrais presented to the International Congress of Medicine in London a method of applying radium in the treatment of prostatic carcinoma by means of a catheter in the urethra which showed apparently remarkable results. Starting with this method, we have made various modifications and improvements, and now employ an applicator, as shown in Figure 3. This applicator carries two screened 100 mg. tubes of radium, and can be introduced into the rectum or through the urethra or bladder. In this way carcinoma of the

beneficial results are obtained. To be effective, this method must be used with the clamp, previously described, by means of which the radium is held at the site desired. The treatments are charted as shown in Figure 10. For rectal applications the patient is placed on his side on a comfortable, well-padded table, with the legs flexed and the back against a padded rest, so that the position can be easily maintained. A finger covered with a rubber cot is inserted into the rectum, and by palpation the site for the treatment is determined. The applicator is then introduced by the side of the finger, placed at the predetermined site, and held there by a clamp attached to the table. The patient has no difficulty in

undergoing this treatment for an hour, and thus 200 mg.h. radium dosage is obtained at each treatment. For urethral applications the patient is placed on his back, the urethra properly sterilized, and anesthetized with 4 per cent procaine. The applicator, sterilized with pure carbolic acid which is then washed off with sterile water, is introduced slowly through the external sphincter, until by manipulation the operator is certain that it lies free in the prostatic urethra. If several applications are to be made the first may be made low down near the external sphincter, the second about the median portion of the prostatic urethra, and the third so as to project intravesically. The same instrument can be carried into the bladder (which has been previously partly filled with fluid), the beak turned, and the handle elevated so that the screened radium is made to lie against the trigone in a position not previously used. It is our practice usually to apply the radium through the rectum, urethra and trigonal region on successive days, and never to make an application in the same place a second time. In this way from 1500 to 2000 mg.h. radium may be applied to the region of the prostate and seminal vesicles without producing radium burns. Six hundred to 800 mg.h. may be safely given into the posterior urethra and vesical neck, and a similar amount through the trigone. The total amount of radiation which we often give is between 2000 and 3000 mg.h., and while transient irritation may be produced, definite ulceration is avoided. The immediate result obtained by this method is, first of all, complete cessation of hematuria, in cases in which this is present, a gradual reduction in the size of the carcinoma, with eventual lessening in the difficulty and frequency of urination and, in some cases, complete restoration to normal urination. In many cases the carcinomatous mass, as felt by rectum, undergoes great diminution in size and in some cases the prostate eventually feels normal on rectal examination.

However, we cannot report a single cure in a case followed for a long period of years, and owing to the presence of metastases in most of these cases before operation, radical cures are not to be expected. But even where metastases are not present, and the tumor mass apparently disappeared completely, subsequent metastatic involvement occurred in most cases. The method, therefore, is not to be considered as a radical cure, and should never be used instead of the radical operation previously described, when the case is suitable for complete extirpation of the prostate and seminal vesicles. That wonderful betterment can be obtained in most cases has been proved by scores of cases in which this method has been employed at our clinic.

Introduction of Radium Needle through the Perioneum or Bladder. Here, again, we have no case of complete cure to report. In some cases there has been a great diminution in the size of the mass, and even an apparent disappearance of the carcinomatous involvement, but the results obtained have not been as satisfactory as those we have obtained with a simple application of radium through the rectum, urethra and trigone, and we no longer use needles. The bladder is sometimes opened for some reason in carcinoma of the prostate, and we have introduced the needles through the suprapubic wound. The 1 mg. needles with thread attached, and also the needles with larger amounts, attached to a shaft, have been employed. In a few cases immediate improvement and a restoration of voluntary urination have been obtained, but here again, no radical cures have been secured.

Conservative or Partial Resection of the Lateral and Median Lobes of the Prostate to Remove Obstruction. This method, which was first employed by us in 1904, has been used in several hundreds of cases. The technique is similar to that which has been described for perineal operations in benign cases. It is particularly applicable where lateral hypertrophy of the prostate is

present concommitant with the carcinoma of the posterior portion of the prostate, and the results obtained are surprisingly satisfactory.

FIG. 11. Young's conservative intracapsular resection of lateral lobes of prostate through perineum, to remove obstruction in case of carcinoma.

course of rectal and urethral radium had greatly reduced the prostatic mass, but obstruction at the prostatic orifice persisted.

FIG. 12. Conservative perineal prostatectomy to remove obstruction in carcinoma of prostate. In this case lateral masses have been removed first and median lobe is being dissected out separately from in front of ejaculatory ducts.

The technique is shown in Figures 11 and 12. The immediate closure of wounds in these cases is equally as rapid as in the cases of benign hypertrophy of the prostate, and in a large majority of the cases, no obstructive symptoms re-appear, and usually the patient has urinary comfort as long as he lives. This method, we believe, is far preferable to the simple suprapubic drainage which has been considerably advocated. In my experience, suprapubic drainage is at best difficult to maintain satisfactorily, is uncomfortable and often painful. By means of conservative partial prostatectomy, a wonderfully good functional result is obtained, and in many cases, almost normal urination secured which may continue as long as the patient lives.

The punch operation may also be successful in removing obstruction, but only when hypertrophied lobes are not present. It is best suited to bars at the prostatic orifice. I have reported its successful use after a

Résumé. If the diagnosis of carcinoma of the prostate can be made sufficiently early, radical operation on the prostate, with its capsule, seminal vesicles, neck of the bladder, and part of the trigone, excised in one piece, should be carried out. With this operation, a large percentage of cures should be obtained. In later cases the use of radium through the urethra, bladder and rectum is effective, particularly in stopping the hematuria and increasing the interval and ease of urination. With marked obstruction to urination, or complete retention, conservative perineal prostatectomy, with removal of the lateral and median portions of the prostate, careful preservation of the mucous membrane of the urethra and vesical neck, is a remarkably good method, and lasting good results have been obtained in a large percentage of the cases. The punch operation also has an important place.

SARCOMA OF THE PROSTATE.—A careful review of our records shows 20 cases of sarcoma of the prostate and its adnexa.

We have found these cases to be of four types: (1) those in which the prostate alone is involved, 2 cases; (2) those involving the

followed for three years, 2 seven and one-half years, and 1 eleven years. In all these cases the application of radium through
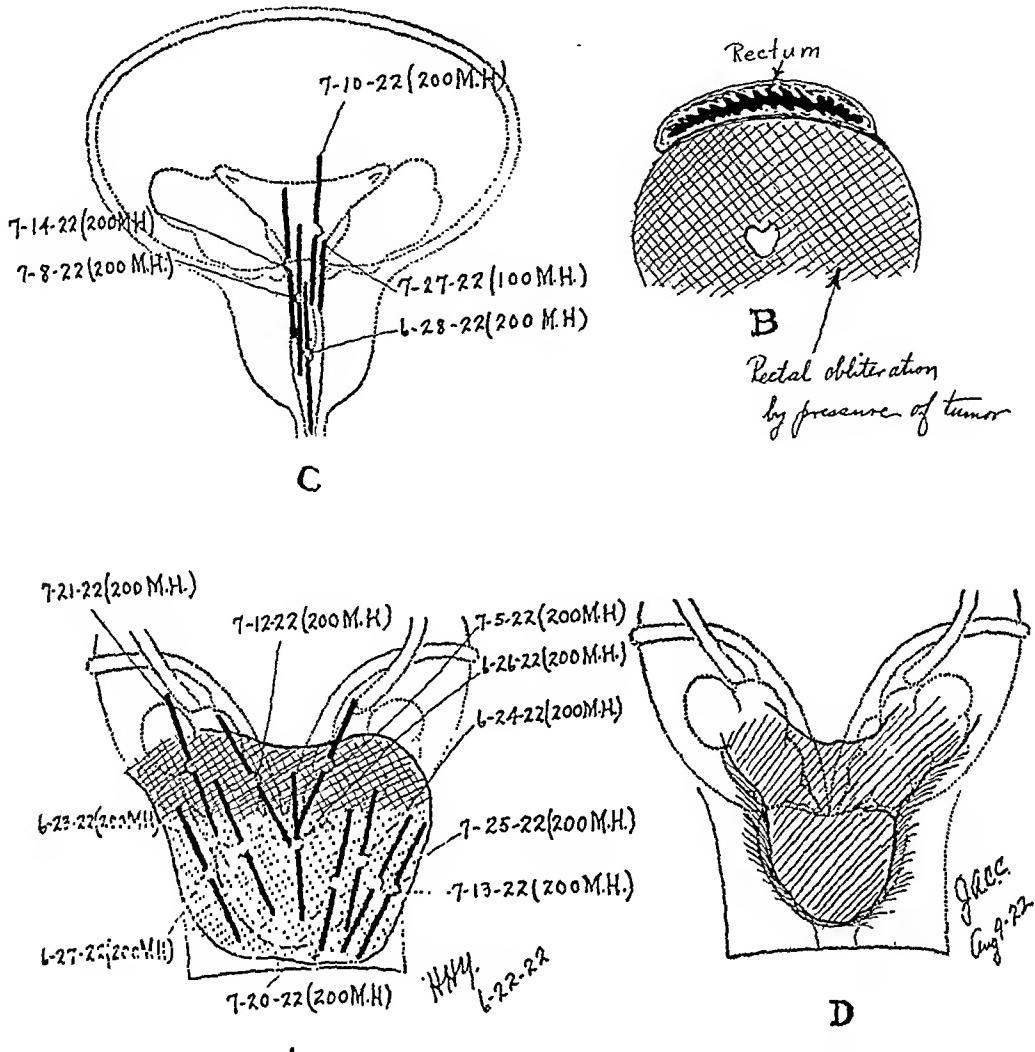
FIG. 13. a, Chart of rectal examination in case of sarcoma of prostate on which applications of radium per rectum are shown with dates and milligram hours. b, Cross section showing great size of tumor and manner in which rectum was pressed. c, Chart showing applications of radium made through urethra. d, Rectal chart, same case, two and one-half months later, showing prostate reduced to normal size and apparent complete disappearance of tumor. Patient now well seven years.

prostate and seminal vesicles, 10 cases; (3) those involving only the region of the seminal vesicles, 5 cases; (4) those lateral but adjacent to the seminal vesicles, 3 cases. Two of these cases have been subjected to operation with poor results. Most of the others have been treated with radium with some remarkable disappearances of a very large sarcomatous tumor. Four cases were apparently cured completely. One of these patients has been

the rectum and also through the urethra and trigone was followed by rapid diminution in the tumor, and eventually complete disappearance. In most cases, after a full amount of radium had been employed, deep roentgen-ray therapy was also used with apparent benefit. While the use of roentgen-ray therapy has not been positively beneficial in many cases of tumors of the bladder and in carcinoma of the prostate, we are convinced that it is of great value in

the treatment of sarcomas of the prostatic region, but radium should always be employed. Owing to the widespread extent

Fig. 14. Sarcoma of ischiorectal fossa between bladder, rectum and pelvic wall, involving seminal vesicles. Treated by radium applications with complete disappearance of tumor. Followed seven and one-half years. Apparent complete cure. Urination normal.

of these tumors, large amounts of radium can be used without danger of rectal or urethral burns. The extent of the tumor, and the application of radium and the results obtained are shown in Figures 12–14. The extraordinary results obtained with radiotherapy in sarcomas should be impressed upon the medical profession. They should be impressed with the importance of making rectal examinations in obscure pelvic and abdominal disease both in children and adults, and to suspect retrovesical enlargements of the prostato-vesicle regions. Some of these tumors are very soft, and most of them elastic. Occasionally they are quite inelastic and hard.

The diagnosis of sarcoma is usually apparent. The fact that many occur at a much earlier age, even in infancy, contrasts them definitely with carcinoma of the prostate.

CONCLUSIONS

In conclusion I wish to say that the last ten years has seen great strides made in the cure of malignant tumors of the bladder and prostate. Whereas surgery has made great progress, particularly in the radical resection of the tumors of certain portions of the bladder and in carcinoma of the prostate, the greatest benefit has been obtained by the use of endovesical treatments of high-frequency electrical applications and the use of radium, with or without the use of the cystoscope. The principal difficulty is still in the lateness of diagnosis. If the medical profession could be persuaded to institute careful rectal and vesical examinations in all cases of urinary, lower abdominal or pelvic complaint, many early tumors of the prostate and bladder would be detected and brought to prompt curative operation. If the profession could appreciate Osler's dictum that "the difference between a good doctor and a poor one is that the good doctor knows how to do a rectal examination," many more early cases of malignant disease could be brought to the surgeon for a cure. With the use of modern methods radical cures can be obtained in malignant disease of the bladder and prostate in a surprisingly large number of cases, and the results compare very favorably with those obtained in malignant disease in other parts of the body.

EDITORIALS

CANCER AND TUBERCULOSIS

IN an editorial on "Cancer Control" published in this journal last June,[1] the reader's attention was called to a suggestive feature in public health reports from all over the world, i.e.: the steady decline in the number of deaths from tuberculosis and the equally steady advance of cancer. In England, during the period 1871 to 1875, the mortality rate per million in the two diseases was as follows: tuberculosis 2217; cancer 445; while that of a later period, 1906 to 1910 was: tuberculosis 1106; cancer 939.

During the last year much attention has been given to the subject of cancer and tuberculosis and two papers of unusual interest have been published. One of these is by Raymond Pearl[2] who bases his study upon the extensive autopsy material of the Johns Hopkins Hospital. Pearl believes the problem, the constitutional differences between the tuberculous and the cancerous, to be primarily a statistical one; and he has compiled a series of excellent tables dealing with various aspects of the problem. In his discussion thereof, two questions come under consideration, i.e.:

1. To what extent, in point of frequency, was tuberculosis, active or healed, associated with the presence of malignant neoplasms in the 816 cases of malignancy comprised in this autopsy material?

2. Were tuberculous lesions, active or healed, found at autopsy more or less frequently in this group of 816 cases of malignant neoplasms, than such lesions would be expected to be found in an equal number of non-cancerous persons, of the same age, sexes, and races as the 816 persons composing the cancerous group?

To quote Pearl:

Active tuberculous lesions were found at autopsy in only 6.6 per cent of 816 persons having malignant growths of one sort or another and in 16.3 per cent of 816 persons without malignant tumors, but of the same

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race, sex, and age as the former group. In short, active tuberculous lesions occurred over twice as frequently in the controls as they did in the malignant group in the present material taken as a whole.

In both the malignancy and the control groups the percentage of cases showing active tuberculous lesions is smaller in the females than in the males, with the exception of the small group of colored female controls. This exception is probably in no wise significant, but instead represents merely a chance deviation of sampling incident to the small numbers involved. In general the sex incidence of active tuberculous lesions in the material here under discussion accords with the well known fact that the rate of mortality from tuberculosis tends to be lower in females than in males . . .

Considering separately the carcinomatous and the sarcomatous groups, it is seen that the same general relationship exists in both relative to the infrequent coincident occurrence of malignancy and active tuberculosis. But the apparent antagonism between these two pathological states is more marked in the sarcomatous group, as compared with its control group, than in the carcinomatous group. Thus, taking the last line of the table (not given here) which is the average of all the data, it is seen that active tuberculous lesions occur 2.2 times more frequently among the controls of the carcinomatous than among those having carcinoma; whereas such active tuberculous lesions occur 3.3 times more frequently among the controls of the sarcomatous than among those having sarcoma. It should not be overlooked that this difference is to be expected, in some part at least, from the fact that the average age of those dying of sarcoma is lower than the average of those dying of carcinoma.

Pearl calls attention to the fact that tuberculosis is, on the whole, a disease predominantly of early life, and cancer is a disease predominantly of later life. A study of a table comprising 1632 autopsies arranged in separate decades of age, leads Pearl to the following conclusion: "In each decade of age, over the whole life span, cancer or other malignant tumors occur less frequently in those with active tuberculosis, than in either the non-tuberculous or those with old healed lesions. The only

exceptions are in a few instances where the number of individuals involved is too small to give a reliable result."

The long-recognized antagonism between cancer and other infectious diseases, particularly tuberculosis, is pointed out by Pearl. According to the latter, Rokitansky[3] was the first to attempt any real analysis of the problem. He stated that in the sites where tuberculosis is frequently found, for example, the lungs, cancer is rarely found. Hirschowitz,[4] in an analysis of five years' autopsies at Prage, found cancer in only 4 of 944 deaths from tuberculosis. According to Pearl:

There is evidence that the infrequent occurrence of cancer and active tuberculosis together is not a unique phenomenon but instead is only one of the manifestations of the tendency towards the non-association of cancer and infectious diseases . . . The evidence set forth in the first part of this paper seems conclusive, to an overwhelming degree, to the effect that florid active tuberculosis and cancer occur together only with the greatest rarity. This obviously suggests an experimental enquiry to determine whether the presence in any animal of much active tuberculosis protects at any degree against the aquisition of cancer or retards or inhibits the growth of a malignant tumor already present . . . Centanni and Rezzesi[5] worked with a strain of mice rather highly resistant to infection with the tubercle bacillus, and a transplantable adenocarcinoma which had a virulence of about 100 per cent. Injection of a mixture of cancer cells and living tubercle bacilli produced no tumors. Simultaneous injections of these two materials separately in different parts of the body depressed the rate of development of the tumor, though in some cases only temporarily. Previous infection of the animals with tubercle bacilli delayed the development of the subsequently inoculated tumor. Injection of the bacilli into an already growing tumor partially destroyed it, but some of the animals died with toxic symptoms. Dead tubercle bacilli had no influence in parallel experiments. Tuberculin mixed with the tumor emulsion retarded or inhibited growth.

McCaskey[6] expresses the opinion that "In view of these apparent antagonisms,

and the occasional retrogression of cancer after the use of tuberculin (though very doubtfully attributable to the latter), it would seem worth while in properly selected inoperable cases of cancer to try the systematic local injection of tuberculin in the cancerous tissue." At the suggestion of Pearl, a small number of carefully selected cases of malignancy are now being treated by Dr. Alan C. Sutton, a member of the staff of the Johns Hopkins Hospital, under the direction of and in consultation with the former.

In a summary of his studies, Pearl points out the interesting fact that:

In 886 persons of both sexes and races compared, who had *a great deal of florid, active tuberculosis* (acute, ulcerative tuberculosis of the lungs or intestines, tuberculous meningitis, caries of the vertebrae, etc.), there were but 11 cases of malignant tumors, or 1.2 per cent of the total number. On the other hand, in 886 persons with no recorded lesions of tuberculosis at autopsy, having the same age, sex and racial distribution, case for case, as the very actively tuberculous, there were 82 cases of malignant tumors, or 9.3 per cent. Among the females, both white and colored, there was not a single case of malignant growth in those with much active tuberculosis. This general result is confirmed in each separate age, sex, and color group, save for a few cases where the numbers are too small to give any reliable indications whatever.

It may be recalled that in the editorial already mentioned[1] a brief reference was made to Cherry's paper on "Cancer and Acquired Resistance to Tubercle."[7] Since then this author has published a very elaborate paper on "The Tubercle Bacillus and Cancer in Mice."[8] It is most interesting to compare his observations with those of Pearl.

According to Cherry, mice were selected as best suited for such an investigation because they are liable to spontaneous cancer and also highly resistant to tuberculosis. Seventy-four were inoculated immediately beneath the cuticle of the skin and 22 at the corresponding depth at the margin of the mucous membrane of the lip.

He states:

The emulsion was prepared from a glycerine-agar slope about a month old, rubbed up in sterile salt solution to which a trace of bicarbonate of soda had been added. When by the opacity it was estimated to be above one thousand millions per cubic centimetre it was spun at three thousand revolutions for one minute and used at once, the needle being charged from the upper supernatent fluid layers. After the inoculations were completed, the number of organisms was determined by the haemacytometer count and also by Breed's method,[9] the amount delivered by the needle being already known.

The estimate of the number inoculated varied from 5,000 to 150,000 from different emulsions. On the average cultures of tubercle bacilli contain about 4,000 millions to the milligramme. Hence a dose of 100,000 bacilli is equal to one forty-thousandth milligramme. The actual number of the bacilli is of less importance than the uniformity of the dose delivered by the needle. Five hundred gramme guinea pigs were inoculated beneath the cuticle from the emulsion used. Three of these receiving 150,000 bacilli have died at periods of 141, 145 and 155 days after inoculation. In a second series receiving 100,000 organisms three have died at 166, 173 and 175 days respectively.

In this study, the term "cancer" is used to include all forms of malignant tumors.

According to Cherry, these experiments show that:

Minute doses of tubercle bacilli in mice are followed by varied conditions including: (1) Tuberculoma, (2) lymphoid hyperplasia running on to leuchaemia and lymphosarcoma, (3) sarcoma, adenoma and carcinoma, some of which have characters not before described in mice, (4) the bacilli may remain recognizable in the tissue for at least half the lifetime of the mouse, (5) as the lymphocytic reaction persists this may be taken as evidence of the presence of a chronic irritant, presumably the bacilli . . .

Various strains of bacteria have been isolated, inoculation of which is followed in a variable percentage of cases by the appearance of true tumors both mesoblastic and epithelial. Some of these are transplantable into other mice, but the bacilli cannot be found in the secondary growths or in the transplants.

Animal parasites both in the lower animals and in man, ehemical substanees taken internally and external irritants, such as radiant energy, heat and tar, are all well established as causes of tumors.

In these instanees true tumors are produced and the value of such elinieal and exprimental results is not the light that they throw on the cause of the common forms of human eanecr, but in demonstration of the faet that eanecr is caused by a number of unrelated internal and external irritants. The apparent eauscs are multiple, the resulting produet—malignancy— is a unity. Hence it is almost certain that these are the indireet causcs and that the unity is aehieved through a specifie meehanism whieh they set in motion and whieh beeomes the direct eause of the tumor. Malignant growths in their essentials are always the same, beeause they consist of a part of the body whieh has aequired the power of unrestricted growth. Among the higher animals they thus eonstitute a separate physiologieal phylum.

This "specific mechanism" mentioned by Cherry may be the "specific factor" of Gye.[10] In our opinion, Gye's theory comes nearer to solving the problem of the etiology of cancer than does anything that has as yet been proposed. At this point it may be well to repeat a statement made in our earlier editorial[1] already referred to (June, 1928), as follows:

The laek of complete confirmation of Gye's laboratory experiments does not matcrially weaken the theory presented. Perhaps he tried to prove too much. In dealing with the problem of human cancer we do not need to go as far as to assume that the microbic agent is actually destroyed but that it is simply reduced in virulence. We need only assume that the body cells normally have such a high degree of resistance to the infection that it is harmless until this resistance is broken down by some of the factors mentioned. We may never be able to produce in the laboratory the exact conditions that obtain in the human body, but from what we do know of the possibility of breaking down the resistance of certain microorganisms by simple chemical changes in the body fluids, it is quite permissible to assume that similar changes may be brought about in the development of malignant tumors.

Cherry summarizes his remarks as follows:

1. The effects of inoculation of small numbers of tubercle bacilli beneath the cuticle by the method described in a series of 96 white mice are recorded.

2. The incidence of tumors in the stock of mice used is 6 per cent. After inoculation it rose to 55 per cent in the males and 71 per cent in the females. About one-third of these tumors are mesoblastic and two-thirds epithelial.

3. In range of type and situation this series of neoplasms differs materially from any hitherto recorded in mice. Those arising in the thyreoid, pylorus, colon, pancreas, prostate and bladder have not hitherto been observed in this animal.

4. These mice also exhibit an associated syndrome of lymphoid changes. The relationship of these on the one hand to leuchaemia and pseudo-leuchaemia and on the other hand to lymphosarcoma is traced and the aetiology of the condition discussed.

5. Death occurred on the average in eight and a half months after inoculation. The occurrence of tuberculomata, the finding of acid-fast bacilli in 10 per cent of the mice and the lymphocytic eharacter of the associated lesions are held to indicate that the bacilli have established themselves in the tissues.

6. The facts submitted afford strong presumptive evidence that the tubercle bacillus is the indirect but essential agent in the promotion of neoplastic growth in these mice. Suggestions are made as to the possible mode of its action.

7. Intraperitoneal inoculation of eorresponding doses of baeilli in fourteen mice gave negative results in regard to the presenee both of tumors and lymphoid syndrome.

In Cherry's experiments it is admitted that the strain of miee employed was highly resistant to the tubercle bacillus. These experiments, however, would seem to prove that the tubercle bacillus when given in certain quantities may aet as

another example of a specific factor that breaks down the resistance of the normal cells to the unknown agent which is the cause of malignant tumors. The autopsy studies of Pearl, on the other hand, gives strong confirmation of the opinion that there exists a definite and powerful antagonism between tuberculosis and cancer. It is difficult to explain this action on any other theory than that the causative agent of the various types of malignant disease, grouped under the general term of cancer, is of microbic origin. This opinion is strengthened by the definite knowledge that a number of various other diseases all of bacterial origin, notably erysipelas, have the same antagonistic action. Pearl's reference to Eschweiller's paper[11] does not mention any of the clinical facts contained in the latter. In brief, Eschweiller who made a very complete study of the effect of accidental erysipelas upon malignant tumors, collected 69 cases from the literature; 27 of these were sarcoma, 38 carcinoma, and 5 were of an undetermined type. Of the sarcoma group, 7 showed temporary improvement, the tumor entirely disappeared in 10, and in one case the disease disappeared but later recurred; there were 9 apparent cures, and 4 patients were well from two to eight years. In the 38 carcinoma cases, 12 showed temporary improvement, in 8 the tumor entirely disappeared, in 3 a recurrence followed the disappearance of the disease, there was no apparent effect in 9 cases, and in 6, the patient died of an attack of erysipelas. In view of the fact that it has been found possible to utilize the curative action of the streptococcus of erysipelas on malignant tumors by the employment of killed cultures,[12] it would seem highly important to carry out a similar experimental study of the action of the tubercle bacillus upon malignant tumors in human beings. The results of the experiments now being conducted at the Johns Hopkins Hospital will be awaited with great interest.

WILLIAM B. COLEY.

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THE THIRD ANNIVERSARY

THIS is the third anniversary of THE AMERICAN JOURNAL OF SURGERY, New Series. In celebration of this event we asked Dr. William B. Coley to edit this issue. The contents of the May number are noteworthy in that Dr. Coley has presented a truly "all star cast." Every contributor is a man of national or world-wide reputation. Dr. Coley has set a precedent that will stand as an editorial achievement for a long time.

The American Journal of Surgery begins its fourth year under the imprint of Paul B. Hoeber, Inc., with great expectations for the future. In the past year it has added several thousand new subscribers to its lists. We have received hundreds of letters from readers from all parts of the country telling us they liked the material offered them. Many made helpful suggestions which we are putting into effect. What pleases one does not please the other and no one can satisfy everyone all the time, but on the whole the great majority of our readers seem to have found the JOURNAL and its practical everyday workable type of article to their liking.

We have splendid plans for the future. We have material in hand for some notable issues. We can assure our readers about one hundred and fifty pages of interesting reading matter each month. We truly base our promises for the future on the achievements of the past.

THE AMERICAN JOURNAL OF SURGERY's circulation is scattered to every state in the Union. Every city of any size has its subscribers, but the impressive fact is that thousands who receive THE AMERICAN JOURNAL OF SURGERY live in little, crossroads villages.

The editor and publishers are eager for constructive criticism. We believe there is a definite place for a journal of this type. We also admit there are other needed excellent surgical journals and that they play important rôles in American surgery.

To Dr. William B. Coley, to the contributors to the American Journal of Surgery for the past year, and to our subscribers we send birthday greetings and best wishes.

In this issue articles are placed alphabetically according to author. Each article is of such importance that any other arrangement seemed inadvisable.

<div align="right">T. S. W.</div>

GEORGE RYERSON FOWLER, M D.

[1848-1906]
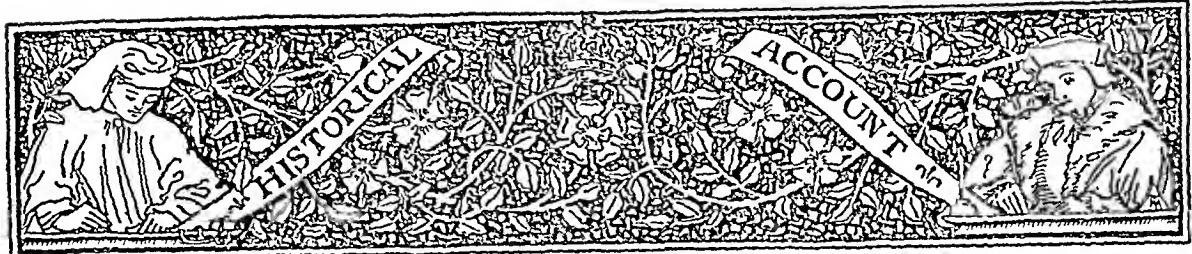
THE FOWLER POSITION

GEORGE RYERSON FOWLER was born in New York City, December, 25, 1848. He died February 6, 1906 following an operation for appendicitis.

He graduated with the degree of M.D. from the Bellevue Hospital Medical College in 1871.

He practiced in Brooklyn, engaging in general practice for 15 years, after which time he did surgery exclusively, having one of the largest practices in this field on the American continent.

His scientific connections were numerous. Dr. Fowler during his career was Visiting Surgeon to the Bushwick Hospital (six years later Consulting Surgeon), St. Mary's Hospital, Methodist Episcopal Hospital, German Hospital, Surgeon-in-Chief to the Brooklyn Hospital, Consulting Surgeon to the Relief Hospital of the Eastern District, the Norwegian Hospital and St. Mary's Immaculate Hospital of Jamaica, N. Y. For five and a half years he was Professor of Surgery of the New York Polyclinic Medical School. He then became Professor Emeritus of Surgery at that institution.

Among Dr. Fowler's society affiliations were: Fellow and Treasurer, American Surgical Association, Vice-President, New York Academy of Medicine, New York Surgical Society, Brooklyn Surgical Society, Brooklyn Pathological Society, Medical Society County of Kings (President and at the time of his death, Chairman of the Board of Trustees), Membre de la Société Internationale de Chirurgie, and Honorary Member of the National Association of Railway Surgeons.

He was appointed Examiner in Surgery to the Board of Regents of the University of the State of New York.

He ran the gamut of the National Guard of New York State from regimental assistant surgeon to surgeon general. He served in Cuba throughout the Spanish-American War, being commissioned by President McKinley as Chief Surgeon of Division, United States Volunteers, with the rank of Major.

In 1897 he was a delegate to the International Medical Congress which convened in Moscow, Russia, and again to one in Paris in 1900.

In 1890 the Red Cross Society of Brooklyn was organized and Dr. Fowler was elected president.

He was a voluminous writer on surgical subjects. For several years he was Associate Editor of the *Annals of the Anatomical and Surgical Society*, afterwards the *Annals of Surgery*. He wrote a treatise on Appendicitis in 1894 which was revised and enlarged in 1900 and translated into German and published in Berlin in 1896. At the time of his death Dr. Fowler had finished two volumes on General Surgery.

His name will long be associated with general surgery, especially with thoracic surgery and in abdominal surgery with appendicitis, and with the position, worked out with his son, Dr. Russell S. Fowler of Brooklyn, in the treatment of general peritonitis, internationally known as the "Fowler position."

T. S. W.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

WITCHCRAFT IN PENNSYLVANIA

FRANCIS R. PACKARD, M.D.

PHILADELPHIA

IT would hardly be thought possible that witchcraft would enter seriously into the trial of a criminal suit in the courts of the State of Pennsylvania, yet such has been the case, and the writer has in his possession a book which figured prominently in the testimony at the trial. Briefly stated, the chief facts in the case were as follows: A farmer named Hess living with his family not far from York, Pennsylvania, suffered various misfortunes to his chickens and crops. In that neighborhood, there practiced quite a few "witch" or "hex" doctors. The Hess family consulted one of these "hex" doctors, named John H. Blymer, who told them that they had been "hexed" by an elderly farmer named Nelson Rehmeyer, and that they could deprive him of his power of casting spells upon them in two ways, by cutting off a lock of his hair and burying it eight feet under ground, or by securing possession of a book which Rehmeyer had in his possession, entitled, "The Long Lost Friend." The hex doctor Blymer, who was thirty-nine years old, accompanied two boys, William Hess, aged eighteen years, and John Curry, fifteen, to Rehmeyer's house, where they seized him, tried to cut off a lock of his hair, and get the book. The unfortunate victim of their superstitious credulity put up a vigorous fight and was killed in the struggle. His assailants were brought to trial at York, Blymer and Curry found guilty of first degree murder, and sentenced to life imprisonment. Hess was found guilty of second degree murder.

During the trial much evidence was directly or indirectly brought forward showing how widespread was the belief in witchcraft in York County. A similar condition prevails in many parts of Lancaster County.

The writer's copy of the book which was supposed to enable Rehmeyer to cast his spells on the Hess family was purchased in the city of Lancaster on a newsstand in 1920. A number of copies were for sale along with the latest novels and the current newspapers and magazines.

It is a small book, bound in cloth, with the following title: "The Long Lost Friend, containing mysterious and invaluable Arts and Remedies, for Man as well as Animals, with many proofs of their Virtue and Efficacy in Healing Diseases, by John George Hohman, Lancaster, Pa.: Printed for the Purchaser, 1912."

Following the title page is a page which bears the following inscription:

☞ Whoever carries this book with him, is safe from all his enemies, visible or invisible; and whoever has this book with him

cannot die without the holy corpse of Jesus Christ, nor be drowned in any water, nor burn up in any fire, nor can any unjust sentence be passed upon him. So help me.†††

The preface to the first edition follows. It is a curious melange of quotations from the Scriptures, and abuse of doctors, in defence of what the Author calls "Sympathetic Words," in other words, what we now term "sympathetic magic." A few brief quotations will suffice to illustrate its purport:

Where is the doctor who has ever cured or banished the panting or palpitation of the heart, and hideboundness? Where is the doctor who ever banished a wheal? Where is the doctor who ever banished the mother-fits? Where is the doctor that can cure mortification when it once seizes a member of the body? All these cures, and a great many more mysterious and wonderful things are contained in this book; and its author could take an oath at any time upon the fact of his having successfully applied many of the prescriptions contained herein . . . whatever cannot be cured by sympathetic words, can much less be cured by any doctor's craft or cunning.

The Preface concludes: "Given at Rosenthal, near Reading, Berks County, Penna., on the 31st. day of July, in the year of our Lord, 1819. John George Hohman, Author and Original Publisher of this book.

We have been unable to find out any details concerning Hohman, beyond a few boastful statements of his successful practice contained in the pages of his book. He states that it is "partly derived from a work published by a Gipsy, and partly from Secret Writings, and collected with great pain and trouble from all parts of the world, at different periods."

The following are selected from a few of the "Testimonials, which go to show at any time, that I Hohman, have successfully applied the prescriptions of this book":

Katherine Meck, at that time in Alsace township, suffered very much from a wheal in the eye. In a little more than 24 hours, the eye was healed . . .

Michael Hartman, Jr., living in Alsace township, had a child with a very sore mouth. I attended it, and in little more than 24 hours, it was well again . . . Jacob Stouffer, at Heckak, Bucks County, had a little child who was subject to convulsions every hour. I sold him a book containing the 25 letters; and he was persuaded by his neighbor, Henry Frankenfield, to try these 25 letters. The result was that the child was instantaneously free from convulsions, and perfectly well. These letters are also to be found in this book.

In conclusion we will give some examples of the "Arts and Remedies."

A good Remedy for Hysterics (or Mother-Fits) to be used three times.

Put that joint of the thumb which sits in the palm of the hand on the bare skin covering the small bone which stands out above the pit of the heart, and speak the following at the same time:

Matrix, patrix, lay thyself right and safe, Or thou or I shall on the third day fill the grave.†††

Another Remedy for Hysterics and for Colds.

This must be strictly attended to every evening, that is: whenever you pull off your shoes and stockings, run your finger in between all the toes, and smell it. This will certainly effect a cure.

To attach a Dog to a person, provided nothing else was used before to effect it:

Try to draw some of your blood, and let the dog eat it along with his food, and he will stay with you. Or scrape the four corners of your table while you are eating, and continue to eat with the same knife after having scraped the corners of the table. Let the dog eat these scrapings, and he will stay with you.

A good Remedy for bad Wounds and Burns.

The word of God, the milk of Jesus, mother, and Christ's blood, is for all wounds and burnings good.†††

It is the safest way in all these cases to make the crosses with the hand or thumb three times over the affected parts; that is to say, over all those things to which the 3 crosses are attached.

To banish Convulsive Fevers.

Write the following letters on a piece of white paper, sew it in a piece of linen or muslin, and hang it around the neck until the fever leaves you.

```
A b a x a C a t a b a x
A b a x a C a t a b a x
A b a x a C a t a b a
A b a x a C a t a b
A b a x a C a t a
A b a x a C a t
A b a x a C a
A b a x a C
A b a x a
A b a x
A b a
A b
```

Cure for Epilepsy.

Take a turtle dove, cut its throat, and let the person afflicted with epilepsy drink the blood.

A good way to cause children to cut their teeth without pain.

Boil the brain of a rabbit, and rub the gums of the children with it, and their teeth will grow without pain to them.

There are also spells to prevent fires, to compel thieves to restore stolen goods, to release spellbound persons, to prevent becoming charmed or bewitched, as well as to bewitch, and a number of recipes for dyes of various colors.

It is hard to believe that a compilation of such absolute nonsense and superstition can be permitted, or find readers at the present day, but the above are the facts.

A FORGOTTEN MEDICAL CELEBRITY OF PARIS

FIELDING H. GARRISON, M.D., F.A.C.S.

WASHINGTON, D. C.

"Véron, gorgé et repu de tout, disait quelquefois: 'Je manque des privations.'"

EMBALMED in a volume of Sainte Beuve, the concluding four words of this citation constitute one of the best epigrams ever penned, Parisian wit *in excelsis.* The author must have been no ordinary being if, after a surfeit of all the good things of life, he could remain so good-natured and leave "the memory of a man unspoiled;" for the spoiling process usually makes a man a public nuisance. Who, then, was Véron? Why, no less than director of the Paris Opera during 1831–35; founder and editor of the *Revue de Paris* (1829–38); owner and director of the *Constitutionnel* (1838–52); author of the once popular *Mémoires d'un bourgeois de Paris* (1853–55); a member of the *Corps legislatif* (1852–62); the original producer of "Robert le Diable," "La Juive" of Halévy, Auber's "Bal masqué" and Taglioni's ballet "La Sylphide;" the man who persuaded Sainte Beuve to write the "Causeries du lundi" for the Monday *Constitutionnel;* whose funeral was as impressive as those of Meyerbeer and Rossini; and incidentally a graduate of the Paris Medical Faculty (1823) and a practitioner of sorts. Gay dog, *bon vivant* and festive Maecenas of the reign of Louis Philippe and the Second Empire, he is now as completely forgotten as the chamber music of Fesca, played by Parisians in the period when "La Muette de Portici" (1828), "Fra Diavolo" (1830) and "Les Huguenots" (1836) were novelties. As the Spanish proverb runs: "The dead have no friends." Yet when a careless scribe intimated that, within the Paris profession, Véron was regarded as "half a mountebank" (*moitié cabotin*), a lively tea-pot tempest was stirred up in the *Chronique médicale.* It transpired, from recollections of contemporaries still living, that he was really an efficient doctor on occasion, whose *jeux d'esprit*, in his great office of *médecin de l'opéra*, were to remedy the sprains of a Vestris or a Taglioni, the hoarseness of a Malibran, or to stop an "epidemic of ozæna in the ballet." Such deeds of derring do were, doubtless, of the

same "capital importance" as the discovery (by the brothers Goncourt) that the ballet girls cobbled their own slippers, which so perturbed Henry James in one of his Miss Nancy moods.

Son of a stationer, Louis-Désiré Véron (1798–1867) was primarily intended to be a publicist and was really a pioneer in the "scoop" methods of the modern newspaper man. Before he gave up practice in 1828, he had become rather a shameless advertiser of those simple prescriptions, beverages and dietetic dodges which, under high-sounding names, like Wells' Tono-Bungay, profess to fortify health and incite virility in the human frame. One of these was the *paté Regnauld*, for all diseases of the chest, into which Vèron boldly put his entire fortune of 40,000 francs, soon realizing an annual income of equal amount for a long time. As his caustic biographer (Caffe)[1] observes, "it led to the directorship of the opera, thence to journalism, thence to the legislative body, thence to novels fit for porters but read by many ministers of state." When he captured the sinecure of "Physician to the Royal Museums," Véron was laughed at as managing a practice limited to "the broken arms and legs of statues," and the chaffing went on for the rest of his life. When, at his own solicitation, Guizot named him Chevalier of the Legion of Honor, "for meritorious services to medicine" (1838), the nomination was opposed by the Duke of Orleans on the ground that so to decorate an ex-director of the Opera would "break down morale in the Army." Nevertheless, Véron got the cross in 1852. His parliamentary career ended when his constituents realized that his services were limited to voting with the ayes.

He was an infallible good guesser as to the ways of the jumping cat, supremely lucky all his life and unaffected by the ridicule which "in Paris kills only the unsuccessful and the unhappy" (Caffe).

[1] Caffe. *Jour. de conn. méd. et pharm.*, Par., 34:433; 464, 1867.

When he floated the foundering *Constitutionnel*, he deliberately used it to forward the candidacy of Napoleon III, both as to his presidency and the subsequent *coup d'état*, which he regarded as foregone conclusions. From his magnificent apartment in the rue de Rivoli, just opposite the Tuileries, Véron daily saluted the Emperor as he rode by. The salute was invariably returned, but Véron was never made a senator. In spite of wounded vanity, he would have been miscued for the magnifico rôle quite as much as the case adumbrated by the delightful Milt-Gross:

> De Souze,
> Wot he leeved in de bazement high het like a Tsenator,
> Tree gasses whooeezit—dot's right—it's de jenitor!

Or by one of the poets of his own time and place:

> SPADILLE. "Moi, j'ai l'air d'un marquis!"
> QUINOLA. Moi, j'ai l'air d'un ministre!"
> IRUS (*les regardant*). Spadille a l'air d'une oie, et Quinola d'un cuistre!"

A bit chagrined, "Mimi Veron" gave up his newspaper and retired into private life, but continued to regard himself as a very necessary personage, held great receptions in his box at the Opera and treated coming and going politicians cavalierly.

Of lavish hospitality and princely generosity, he paid Eugène Sue 100,000 francs for the right to publish "Le Juif Errant," left about 600,000 francs to his relatives, a legacy of 30,000 francs to his housekeeper and a diamond snuff-box to his physician Ricord. His will stipulated that he was to be buried in a modest manner; but everybody followed his funeral to the church of St. Roch, which was draped in black, with music by a full orchestra, choruses from the Opera and subsequent discourses at Montmartre. After Véron's death, the journalists of Paris, remembering his kindness and hospitality, were a unit in declining to say anything against him. An odd character, worthy of a more extended study by some ocean-crossing M.D., who can investigate *in situ*—but he will have to know his Paris.

BOOK REVIEWS

Another of Springer's splendid productions, DIE ERKRANKUNGEN DER SCHILDRUSE.[1] Covers the entire subject of thyroid diseases (especially Goiter) from the viewpoint of Von Eiselbergs' clinic in Vienna. The specialist will find this book indispensable, though undoubtedly much exception will be taken to Breitner's classification. The ten page bibliography is preceded by a collective, critical abstract of the literature since 1924. This chapter is a distinct innovation and will be heartily welcomed. The absence of an index is to be regretted.

The appearance of each additional part makes one impatient for the completion of DIE CHIRURGIE.[2] Part twenty-three, covering the joints, by authorities like Kroenig, Seifert and Stahnke of Wurzburg, is quite up to the standard set by the parts already published and gives further evidence of the splendid editing of Drs. Kirschner and Nordmann, who are producing a collection of monographs for the general surgeon that will rank with the best.

With the renewed interest in spinal anesthesia which is being evidenced throughout the country Doctor Evans' book[3] is timely. Physicians throughout the land are interested in this form of anesthesia and are giving it a trial in their operating rooms. Many surgeons are strong in their praises of "spinal," others employ it only casually, while others damn it, often without having given it clinical trials. Taken by and large there is much about spinal anestheisa, in the minds of many, clouded with scientific doubt. Many there are who are not familiar with its underlying principles, its physiology, its indications and contraindications, or its technique. Deaths from spinal anesthesia have been rumored and reported. In the great majority of instances a faulty technique is to be blamed and not the method.

Doctor Evans has covered the subject sanely and thoroughly. It is a readable book; it is authentic. When one has finished reading it he will be richer in his knowledge and look upon this method of anesthesia from a new viewpoint. It will pay every anesthetist and surgeon who has occasion, at any time, to resort to "spinal" to possess this book and spend an evening getting familiar with its contents. The whole story of spinal anesthesia is concisely told within its covers.

The Chapter headings are: Introductory; Selection of Patients; Induction of Spinal Anesthesia; The Various Drugs and Their Employment; Phenomena Accompanying Spinal Anesthesia; Possible Complications of Spinal Anesthesia; Care of the Patient; Routine to Insure Speed, Accuracy and Safety; Mortality, Morbility and an Analysis of Causes; Summary and Conclusions; Bibliography and an Index.

It is an important book offered the surgical members of the profession at a time when spinal anesthesia is being given another trial. The majority find it has a definite place in the surgical routine; many are thoroughly conversant with the subject; many try it casually and report failures. Dr. Evans' work is a needed addition to the surgical literature of the day.

Doctor Labat has done a noteworthy piece of work in writing REGIONAL ANESTHESIA.[1] The second edition is proof of its popularity. It is needless to say that any surgeon who pretends to be classed as first grade must know about regional anesthesia or have someone in his clinic able to put it into practical application.

The book covers the method of regional anesthesia, its general principles and technic, blocking the cranial nerves, operations on the head, blocking the spinal nerves, genitourinary and rectal operations, operations on the lower extremities, subarachnoid block (spinal anesthesia), a discussion on subarachnoid block and a general discussion of the value of regional anesthesia.

The book is 567 pages in length, well indexed and illustrated. We earnestly recommend it to every surgeon.

Here[2] are three more books in the National Health Series, edited by the National Health Council. For small, practical books intended for the layman, we know of nothing that sur-

[1] DIE ERKRANKUNGEN DER SCHILDRUSE. By Burghard Breitner. Vienna, Julius Springer, 1928.
[2] DIE CHIRURGIE. Edited by M. Kirschner, and O. Nordmann. Berl., Urban & Schwarzenberg, 1928.
[3] SPINAL ANESTHESIA (Subarachnoid Radicular Conduction Block). Principles and Technique. By Charles H. Evans, M.D. Introduction by W. Wayne Babcock, M.D., F.A.C.S. Foreword By Charles Gordon Heyd, M.D., F.A.C.S. N. Y., Paul B. Hoeber, Inc., 1929.

[1] REGIONAL ANESTHESIA. Its Technic and Clinical Application. By Gaston Labat, M.D. Foreword by William J. Mayo, M.D. Ed. 2. Phila., W. B. Saunders Co., 1928.
[2] CARE OF THE MOUTH AND TEETH. By Harvey J. Burkhart, D.D.S. WHAT EVERY ONE SHOULD KNOW ABOUT EYES. By F. Park Lewis, M.D., F.A.C.S. DIABETES AND ITS TREATMENT. By Frederick M. Allen, M.D. N. Y. Funk & Wagnalls Co., 1928.

passes or even equals these little booklets of which there are now almost thirty volumes on the market. The books are carefully written and edited and contain just the information that the average patient needs. Published at thirty cents each, they are available to everyone and it is to be hoped that they will have the large circulation they deserve.

Any book on biology that has introductions by Prof. Karl T. Compton and Prof. Raymond Pearl is worthy of note. But it does not, of necessity, follow that the author has found the final answer to "What Is Life?"[1] According to Professor Compton, the author's answer to the question purports to be based on "the facts of modern atomic physics."

If we have read the Associated Press dispatches from Berlin correctly "the facts of modern atomic physics" have been called somewhat into question by Professor Einstein and others. Far be it, therefore, from a mere reviewer to attempt to judge where experts differ; but Comptom's statement that "her discussion of modern atomic physics is accurate, well-balanced and worth reading for its own sake," would alone warrant the reading of the book by anyone seeking the answer to "What Is Life?"

According to Professor Pearl, "Mrs. Gaskell's hypothesis is capable of experimental test," which statement would seem to give the book the imprimatur of scientific verity.

Mrs. Gaskell considers the electron the ultimate constituent of life, the variations occurring according to the manner of the combination of these constituents. Whether or not one agrees with the theories propounded by the author, the book will be found a great thought-stimulant and well worth the time given to its reading.

The keynote of this book[2] is the first sentence of the preface: "The aim of this handbook is to present in a practical manner the differential diagnosis of the commoner surgical affections." This the author has succeeded in doing and doing well. His further statement that "Throughout the book the author has had in mind the point of view of the student or practitioner, faced with a case of disease or injury" may also be accepted in toto. In handy format, well arranged with appropriate and easily

found sideheads, this is a book for ready reference which should find a place in every surgeon's library.

This is a book[1] of over 900 pages covering the subject completely and yet concisely, and illustrated with the most unusual pathological plates in color for which credit is given to the *British Journal of Surgery*. The senior author is Hunterian Professor, Royal College of Surgeons of England. The book may be accepted as authoritative and up-to-date. By a clever system of cross reference duplication of material has been eliminated. It is all in all the best book on surgical pathology that has come to the reviewer's attention in years.

On the occasion of last year's 300th anniversary of the publication of William Harvey's epic-making work,[2] R. Lier & Co., of Florence, have issued a facsimile edition of the original. Like all publications of this house, this book leaves nothing to be desired typographically. Every medical man should have a copy of Harvey in his library and here is a perfect reproduction. It seems unfortunate that the publishers have limited themselves to reproducing only the original Latin. All the requirements of the Latin scholar are fulfilled, but the less erudite physician would undoubtedly profit by the addition of a translation. However, the beauty of this edition alone should lead many to looking up some of the splendid translations now available.

This book[3] covering the surgical aspects of tropical diseases and their complications should be invaluable to those coming in contact with such conditions. As the author states: "Tropical surgery includes every branch of ordinary surgery, but also demands a knowledge of some special aspects of surgery and various surgical diseases and complications rare or unknown in a temperate climate." In a 12mo volume of 300 pages, at a low price, the author would seem to have covered his subject well and as he is Professor of Surgery at the Medical College of Bengal and Surgeon to the College Hospital and also Examiner in Surgery at Calcutta University the book bears the stamp of authority.

[1] WHAT IS LIFE? By Augusta Gaskell. Springfield. Charles C. Thomas, 1929.

[2] HANDBOOK OF SURGICAL DIAGNOSIS. By Clement E. Shattock. N. Y., William Wood & Co., 1929.

[1] SURGICAL PATHOLOGY. By Cecil P. G. Wakeley and St. J. D. Buxton. N. Y., William Wood & Co., 1929.

[2] William Harvey's EXERCITATIO ANATOMICA DE MOTU CORDIS, 1628 (facsimile edition). Florence, R. Lier & Co., 1928.

[3] SURGERY IN THE TROPICS. By Sir Frank Powell Connor, Phila., P. Blakiston's Son & Co., 1929.

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UTEROSALPINGOGRAPHY

[THIRD COMMUNICATION]

SAFETY OF THE METHOD, COMPILATION OF REPORTS OF UNTOWARD RESULTS, CONTRAINDICATIONS, SURVEY OF RECENT LITERATURE, DISCUSSION OF TECHNIQUE AND THERAPEUTIC APPLICATIONS, AND A NEW SYRINGE WITH MANOMETER ATTACHMENT*

JULIUS JARCHO, M.D., F.A.C.S.

NEW YORK

IN two previous communications[1] on uterosalpingography, published in *Surgery, Gynecology and Obstetrics*, I attempted to give a comprehensive description of this new and important subject. In the first paper, the history of the diagnostic use of iodized oils, first as a means of localizing spinal cord tumors and other causes of intraspinal obstruction and later for the roentgenological visualization of the female internal generative organs, was epitomized. Also, my technique of employing the method and certain typical cases were reported. The second article dealt largely with the action of the "tubal sphincter," a new syringe for transuterine injections and therapeutic applications of uterosalpingography.

In this paper, the third of my series on uterosalpingography, I propose to discuss the alleged dangers of the method, formulate the contraindications, review the additional literature that has appeared since my second article was submitted for publication near the end of 1927, and describe certain technical details and the instrument with manometer attachment which I now use in all cases.

SAFETY OF UTEROSALPINGOGRAPHY

Many gynecologists have been deterred from utilizing uterosalpingography for fear that they might provoke some unfavorable reaction by injecting the iodized oil. If we are to accept uterosalpingography as a standard procedure, we must have a clear conception of its contraindications as well as its indications. To this end, I have made an exhaustive study of the literature for the purpose of compiling reports of untoward results. As will be shown presently, ill effects have been surprisingly few, considering the large number of cases in which the method has been employed.

For my part, I have observed no ill effects other than two cases of acne and am convinced that the method is entirely safe when used in properly selected cases, with good technique and by experienced operators. For theoretical reasons, however, I am inclined to discourage its use in certain conditions.

* Delivered in abstract before the Section of Obstetrics and Gynecology of the New York Academy of Medicine, January 22, 1929.

Pregnancy, I believe, should serve as a contraindication, unless therapeutic abortion is contemplated. Although Heuser[2]
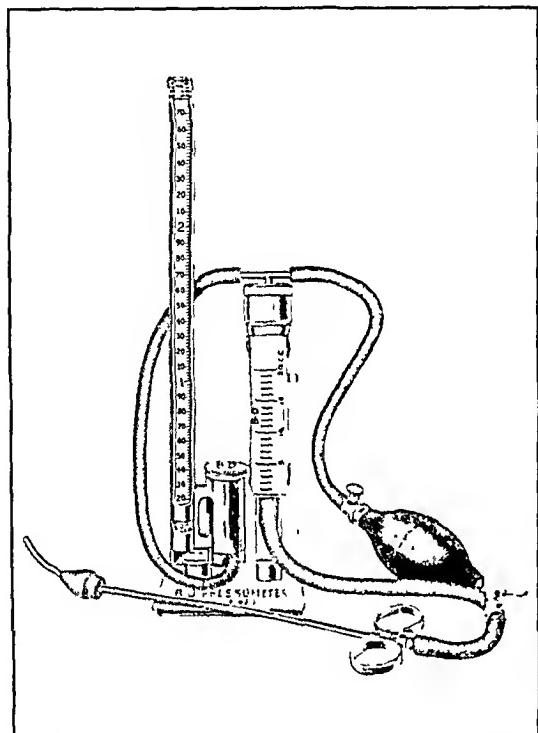
FIG. 1. Author's apparatus with manometer attachment for uterosalpingography. It shows exact amount and pressure of iodized oil injected.

in 1925 contended that the injection of iodized oil does not produce abortion, a number of recent investigators have reported this accident in a definite percentage of cases. Moreover, one should be deterred by the possibility that it may damage the offspring. Until it is proved conclusively that this danger does not exist, I do not intend to employ uterosalpingography in the gravid state unless therapeutic abortion is intended.

Uterosalpingography has been employed for the localization of malignant growths in the uterus. I am opposed to this procedure, because I fear that it may transport cancer cells through the Fallopian tubes into the peritoneal cavity and thus hasten general dissemination.

Gonorrhea and conditions of acute tubal inflammation are, I believe, contraindications, for the reason that there is danger

of carrying the infective material upward along the genital tract and perhaps into the peritoneal cavity. For the same reason, I do not favor the use of uterosalpingography during the menstrual period or for the diagnosis of retained secundines.

Does the injection of iodized oil produce peritoneal adhesions? This question, I am convinced, can be answered in the negative. I have operated upon a number of women after uterosalpingography, sometimes within twenty-four hours, and observed no evidences of peritoneal irritation. Also, there was no deleterious influence on the postoperative course or interference with the healing of the wound. Cases of this nature are illustrated in Figures 4, 13, 14 and 27. In a number of cases the uterosalpingograms proved the patency of the tubes and the presence of free oil in the peritoneal cavity; yet there was not the slightest indication of peritoneal irritation at operation performed twenty-four hours after the injection.

No toxic effects of iodine were observed even after injections of 20 c.c. of the oil. In such cases, assuming that 5 c.c. drain from the uterus, 15 c.c. are retained in the Fallopian tubes and peritoneal cavity. Another possibility is that some of the oil is gradually propelled back from the tubes into the uterus and then drained into the vagina. This supposition is supported by the fact that some patients assert that for days afterward they have an oily discharge with the characteristic odor.

Although my own experience has been that uterosalpingography, properly employed, is free from danger, I have made an extensive review of the literature on this point. As a result, I can report that the great majority of investigators have found the procedure entirely safe. However, there are a few exceptions, which should be noted.

Cotté and Bertrand[3] in 1926 reported that they had used iodized oil for diagnostic purposes in more than 50 cases of acute or subacute inflammation of the

Fallopian tubes and had never noted a rise of temperature or any unfavorable reaction due to the introduction of the oil. In the reported on the use of iodized oil for uterosalpingography in more than 100 cases, in none of which there was any
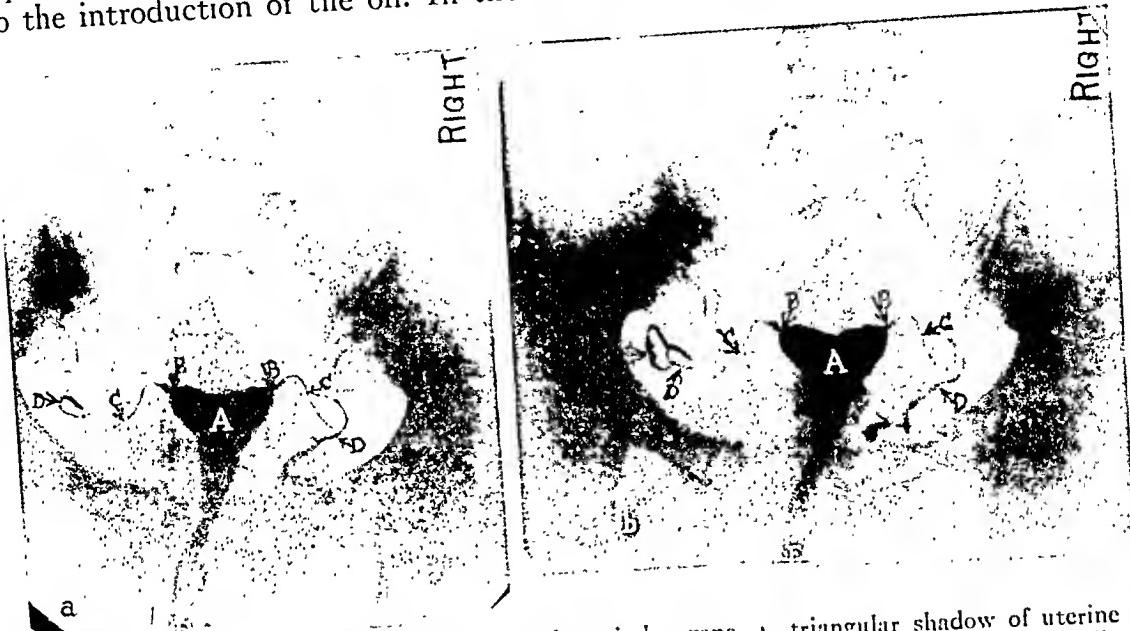
FIG. 2. Uterosalpingogram of normal female internal genital organs. A, triangular shadow of uterine cavity; B, snare-like compression of tubal sphincter; C, isthmus of Fallopian tube; D, beginning of ampulla; E, free iodized oil in peritoneal cavity; F, nozzle and tip used for introducing oil into uterus.

FIG. 3. Anteflexed uterus, showing foreshortening of its vertical diameter. (For explanation of letters compare with Fig. 2.)

same year, Cotté and Pièrre[4] reported that they had given intrauterine injections of iodized oil in 20 cases of acute adnexal inflammation without harm.

More recently, Darbois and Béclère[5]

reaction, sign of peritoneal irritation, or spread of the infection. Yet 30 of these patients had salpingitis at the time when the procedure was employed.

Henkel[6] reported that he had never

observed any untoward results or symptoms of irritation following injections of iodized oil. Also, in patients upon whom he

Jaroschka[7] reported that he had observed no serious reactions from injections of iodized oil although patients sometimes
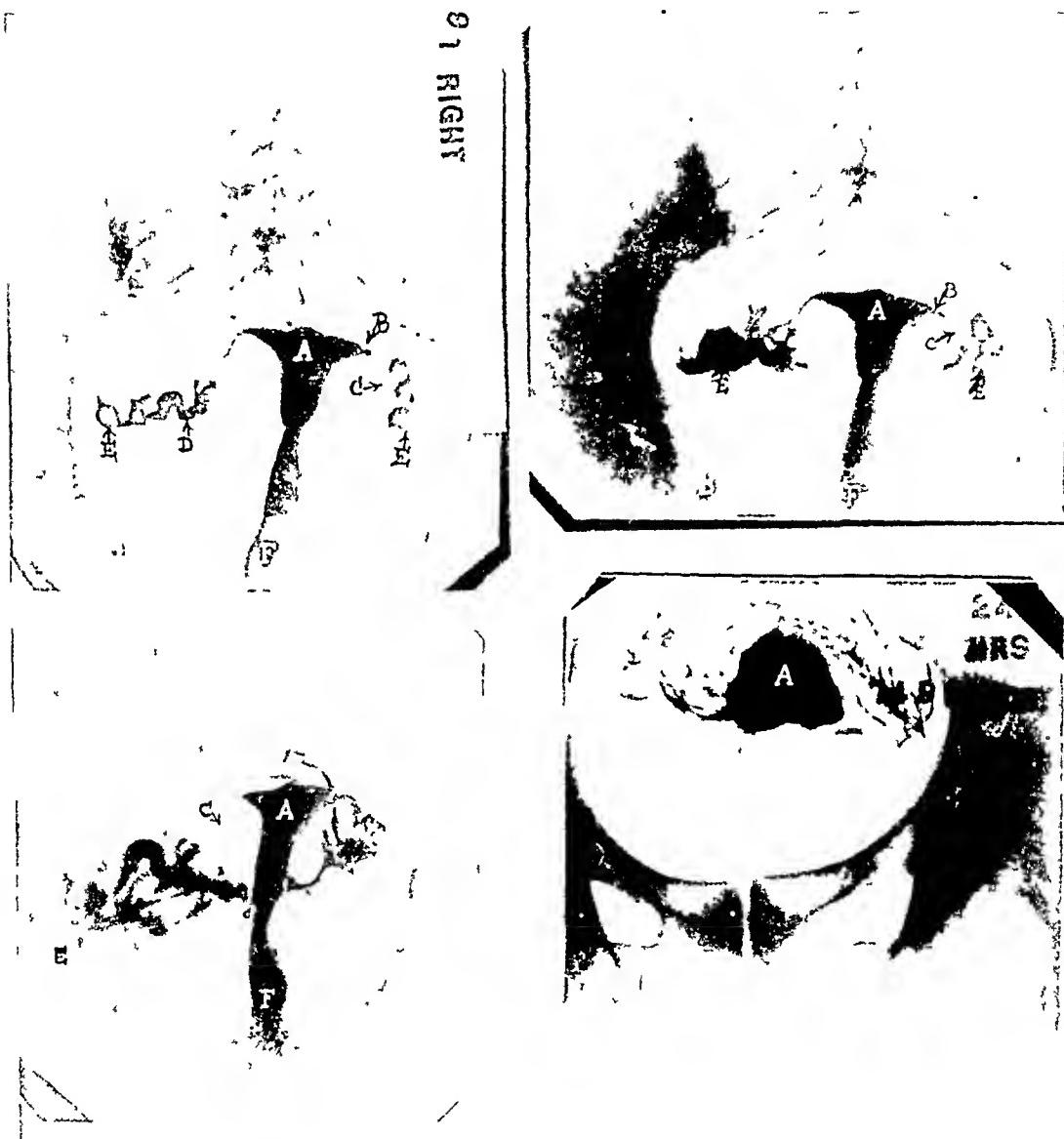
FIG. 4. Retroflexed uterus, replaced anteriorly and injected with iodized oil. Three months later, a modified Gilliam operation was performed. No signs of adhesions or pelvic irritation due to uterosalpingography were found. (For explanation of capital letters compare with Fig. 2.)

    a, b. Normal uterine shadow with large amount of oil in peritoneal cavity.

    c. Lateral prone position.

    d. Twenty-four hours after injection.

    As soon as instruments were withdrawn, uterus fell backward. Because of marked retrodisplacement, oil did not drain off.

    Patient was a married woman, aged twenty-six, who complained of primary sterility (three years). Uterus was retroflexed but movable; adnexa, negative.

operated subsequently, he found no evidences of such irritation in the Fallopian tubes or peritoneum.

complained of pain. Popović[8] employed uterosalpingography extensively without observing any ill effects whatsoever.

Temesváry[9] reported that he had never seen signs of peritoneal irritation after injections of iodized oil. In 35 cases in phy in over 200 cases in the gynecologic clinic of the University of Berlin without observing any ill effects.

Fig. 5. Patency of Fallopian tubes restored after repeated injections of iodized oil. One year previously, both tubes were occluded. (For explanation of capital letters compare with Fig. 2.)

a. Fallopian tubes high in pelvis and atonic uterine cavity.
b. Free oil in peritoneal cavity, proving that tubes are patent.

Patient was thirty-two years old and complained of secondary sterility. She had been married twelve years and had a child of eleven. Following removal of a left ovarian cyst eight years previously, her menses became scant and infrequent. Uterus was found to be small and anteflexed but freely movable. Uterine cavity accommodated 15 c.c. of iodized oil notwithstanding its small size, indicating atony of uterine musculature. First uterosalpingogram revealed occlusion of both Fallopian tubes at their cornual ends.

which operation was performed from several days to several weeks after uterosalpingography, there was not the slightest sign of peritoneal irritation.

Greene and Pendergrass[10] employed uterosalpingography in about 50 cases, in none of which there was any evidence of reaction or untoward effect, either immediate or delayed. On the contrary, there was definite improvement in some of their patients with chronic salpingitis.

Mocquot and Bureau[11] have never observed ill effects from injections of iodized oil even when it entered the peritoneal cavity. They employed the method in about 150 cases. In cases in which they operated after uterosalpingography, they found no evidence of irritation of the epithelium of the Fallopian tubes or of the peritoneum. However, they believe that uterosalpingography is contraindicated during uterine bleeding, in acute infectious and severe suppurative processes, and when pregnancy is suspected.

Schultze[12] employed uterosalpingogra-

In more than 150 cases in which they employed uterosalpingography, Zimmermann and Nahmmacher[13] never found the slightest evidence of irritation or inflammation of the epithelium caused by this medium, nor of peritoneal irritation or toxic effects. Moreover, in experiments on guinea pigs, they found that intraperitoneal injections of iodized oil caused no symptoms of peritoneal irritation and the contrast medium did not cause abort on or affect pregnant animals unfavorably.

In about 170 cases in which uterosalpingography was employed in the gynecologic clinic of the University of Jena, Nahmmacher[14] observed no ill effects. A follow-up study of some of these patients showed that neither pain attributable to inflammatory reaction or adhesions nor any other unfavorable symptoms had developed.

With regard to the safety of lipiodol for gynecologic diagnosis, Forestier[15] made the following significant statement: "No serious accidents have resulted from the

different uses of lipiodol in our hands and we have performed thousands of injections. No fatality has ever been reported.

FIG. 6. Glassful of water into which iodized oil has been squirted from a syringe. Note that heavier oil sinks to bottom and arranges itself there in droplet formation.

The method may be advocated as effective in many cases and quite harmless."

Gauss[16] reviewed the literature on uterosalpingography up until 1928 and found that about 3000 cases in which the procedure was used had been reported. In this series, there were 5 deaths attributed to the method and 13 cases in which infection followed. This is not a large percentage, particularly since in some cases the author's conclusion as to the blame to be placed upon the iodized oil was based on subjective impression rather than objective proof.

Specific reference will now be made to the work of some authors who have observed unfavorable effects following uterosalpingography.

According to Proust and Béclère,[17] such untoward reactions as have occurred after uterosalpingography took place when contrast media other than lipiodol were used. (But in Rubin's[18] unfavorable cases, recently reported, lipiodol was used.) Proust and Béclère cite Hellmuth's[19] fatal case, which followed the injection of umbrenal. They employed lipiodol in 70 cases, including 30 with salpingitis, and did not observe the slightest reaction. There was no rise of temperature or sign

of peritoneal irritation, notwithstanding the fact that the contrast medium penetrated infected tubes in many cases.
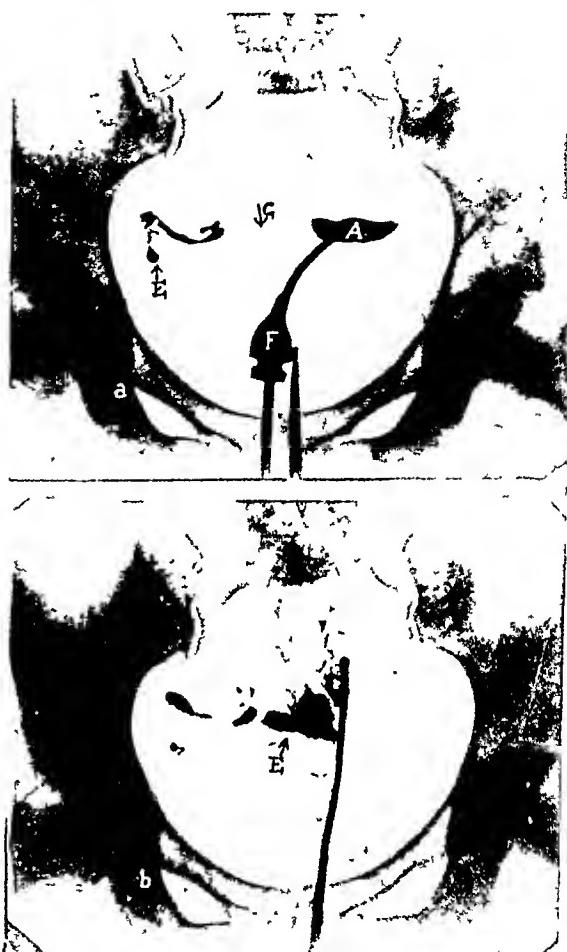
FIG. 7. Sharply anteflexed and dextroverted uterus. (For explanation of capital letters compare with Fig. 2.)

a. Summit of fundus uteri (A) presents itself to view. Right Fallopian tube is occluded at cornu. Left is adherent and greatly elongated.

b. After iodized oil had been allowed to drain off, a sound was introduced to orient position of uterus. Note that it is directed to right, corresponding with position of dextroversion shown in a. There is no shadow corresponding with right Fallopian tube, proving that condition is really one of occlusion and not of a patent tube hidden behind uterine shadow. Left tube is evidently held in adhesions, as is shown by droplet formation of oil in peritoneal cavity.

Patient was twenty-nine years old and complained of sterility. She had been married four years and had one abortion three years prior to examination, but no children. Uterus was small, sharply anteflexed and dextroverted and the cervix was directed downward and forward. Adnexa were thickened and tender.

Further course of this case is shown in Figures 8 and 9.

Rubin and Bendick[20] believe that they

have observed signs of peritoneal irritation in a few cases in which iodized oil entered the peritoneal cavity, but the patients

matory reaction developed after uterosalpingography. In one of these cases, subsequent operation showed definite
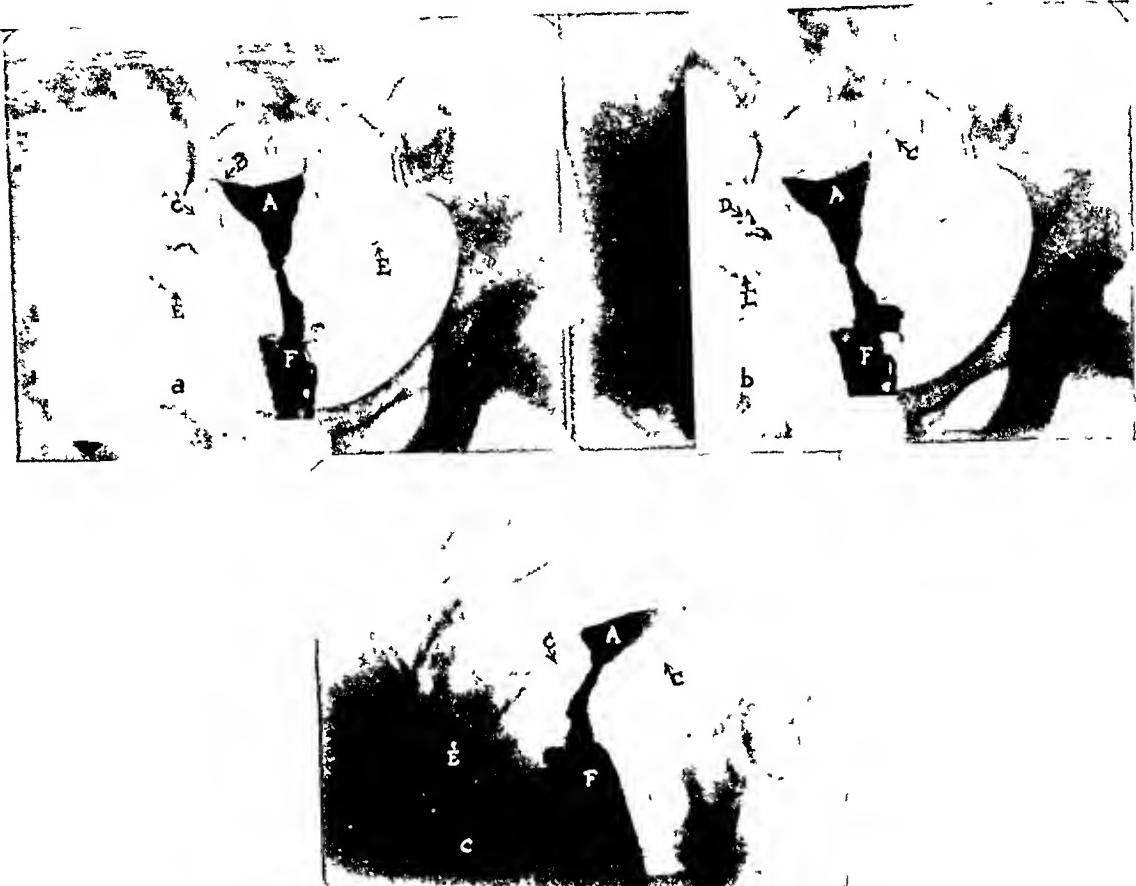
FIG. 8. Same case as Figure 7, three months later. (For explanation of capital letters compare with Fig 2.) It required 3.5 c.c. of iodized oil to obtain this salpingogram.

a, b. Small triangular shadow of uterine cavity is now centrally located, both tubes are patent, and there is free oil in peritoneal cavity. Fallopian tubes are not only patent but have regained their normal contour. Note successive filling and emptying of various portions of tubes.

c. Lateral prone position.

Further course of this case is shown in Figure 9.

were never too ill to visit the office on the following day.

In a series of 66 cases in which uterosalpingography was employed, Rubin[18] observed large pelvic abscesses requiring incision and drainage in 2 cases and symptoms of peritoneal irritation (cramps, nausea, vomiting and pain in the lower abdomen) in 3 others. In a case of pregnancy in which therapeutic abortion was indicated, the injection of iodized oil with no other interference produced evacuation of the uterus in a few days.

Hoffmann[21] cited 2 cases reported by Odenthal[22] in which symptoms of inflam-

evidence of recent inflammation in addition to chronic infection. Hoffmann reported an untoward reaction in 1 case following the use of uterosalpingography for sterility. Symptoms of acute inflammation of the uterus and tubes, not previously observed, developed after this procedure.

Haselhorst[23] reported 2 cases in which injection of iodized oil (iodipin) was followed by pain and fever. The first case was one of ovarian cyst, in which subsequent operation revealed an extensive sterile inflammatory reaction with an exudate involving the Fallopian tubes and adjacent peritoneum. Haselhorst attributed

this condition to the previous uterosalpingography. In the second case, accidental abortion with infection of the

uterine contraction induced by the procedure, he has never observed any ill effects from injections of iodized oil. In only 1 case
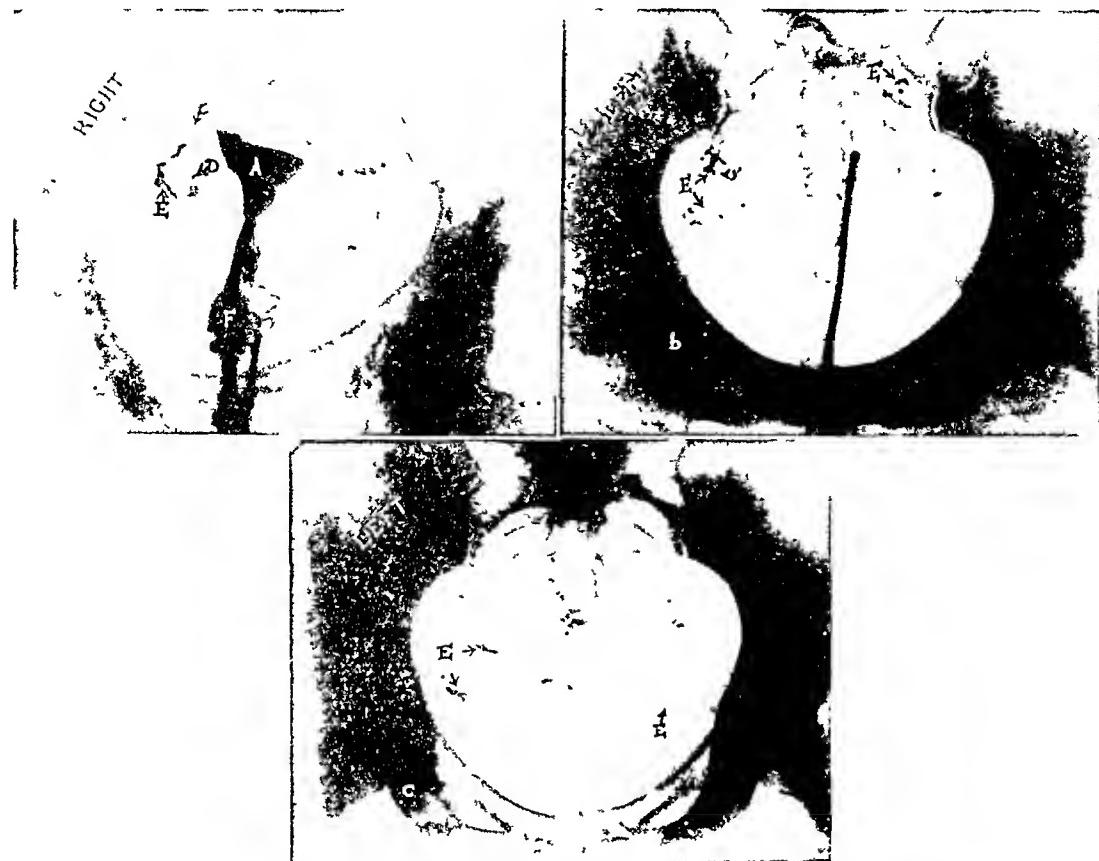
FIG. 9. Same case as Figures 7 and 8. (For explanation of capital letters compare with Fig. 2.)
a. Before removal of nozzle.
b. Immediately after removal of nozzle. A sound has been introduced to orient position of uterus. Uterus had powerful tonus, as was evidenced by fact that oil escaped within a few seconds of time when nozzle was removed from cervix.
c. Normal distribution of iodized oil in peritoneal cavity. Compare with Figure 7.

placenta followed uterosalpingography. Haselhorst believes that, while uterosalpingography is a valuable method of diagnosis, it is not without danger in all cases. Also, he does not consider the presence of free iodized oil in the peritoneal cavity entirely harmless.

Mandelstamm[24] in 1928 reported that in 34 cases in which he employed uterosalpingography rather severe pain resulted, persisting for six hours in one case.

Mathieu[25] reported on the use of uterosalpingography in 80 cases. Although the patient usually experienced slight uterine cramps at the time of injection owing to the

was there a rise of temperature. In this case a fever of 101°F. lasted for twelve hours. Approximately 50 per cent of Matheiu's patients were operated upon within five days of uterosalpingography, and in no case was any evidence of peritoneal irritation found.

Hirst[26] noticed an unfavorable reaction in only 1 case after the injection of iodized oil (lipiodol). Operation was performed twenty-four hours after the test and streptococcic infection of the tubes found. The patient later developed streptococcic peritonitis and died. The rôle of the lipiodol in causing this result is questionable. In

21 cases in which both the Rubin test and uterosalpingography were employed, Hirst found that all of the patients stated that on animals showed that no untoward results followed the injection of iodized oil for this purpose. In human cases no
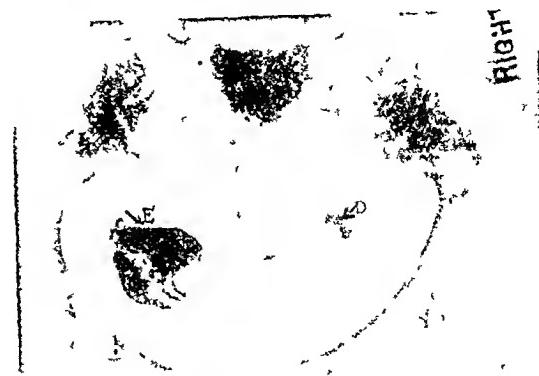
FIG. 10. Fimbriated end of left Fallopian tube embedded in adhesions. (For explanation of capital letters compare with Fig. 2.)

     a. Fimbriated end of left tube is embedded in adhesions. Right tube is dilated and closed at its fimbriated end.

     b. Oil has broken through adhesions on left side. On right side it is still retained in ampulla.

the injection of iodized oil was the less painful procedure.

Belote[27] reported a case in which an iodine skin reaction developed after the use of iodized oil for roentgenography of the lungs. The eruption developed nine to ten days after the injection of the oil. Examination of the urine and saliva gave a strongly positive reaction for iodine. The patient had not been given iodine in other form except three months previously, when he had taken potassium iodide by mouth. Roentgen-ray examination showed the contrast medium present at the base of the lungs.

In a study of the removal of iodized oil from the lungs after intratracheal injection, Brown[28] found that the presence of the oil in healthy alveoli causes a mononuclear infiltration; that these mononuclears are of the phagocytic type; and that these phagocytes are the chief agents in the removal of the oil from the alveoli of the lungs by way of the lymphatic system. The rapidity of the removal of the oil, he observed, is in direct proportion to the number of active phagocytes.

Neuswanger[29] reported the use of iodized oil as a pyelographic medium. Experiments

severe reactions and no signs of toxicity followed its use and the pyelograms obtained were satisfactory.

Taking all the evidence into consideration, we cannot escape the conclusion that unterosalpingography employed in properly selected cases and with strict asepsis and skillful technique is an extremely safe procedure.

REVIEW OF LATEST LITERATURE

The indications for and information to be gained by uterosalpingography have been covered fully in my two earlier communications. It is not intended to review this material here. However, a large number of communications on the diagnostic use of iodized oil in gynecology have appeared since the latter part of 1927, and some of them contain items of importance which I have not previously mentioned. A brief review of the latest literature on uterosalpingography will therefore be of interest.

Darbois and Béclère[5] have increased the scope of uterosalpingography so as to use it in all cases of sterility for the study of the patency of the Fallopian tubes and the exact localization of any obstruction that may be present; for the diagnosis and

localization of pelvic tumors; and for all types of metrorrhagia, especially at the time of the menopause. However, they

to injections of iodized oil by contractions beginning in its lower portion, by which the contrast medium is driven toward the
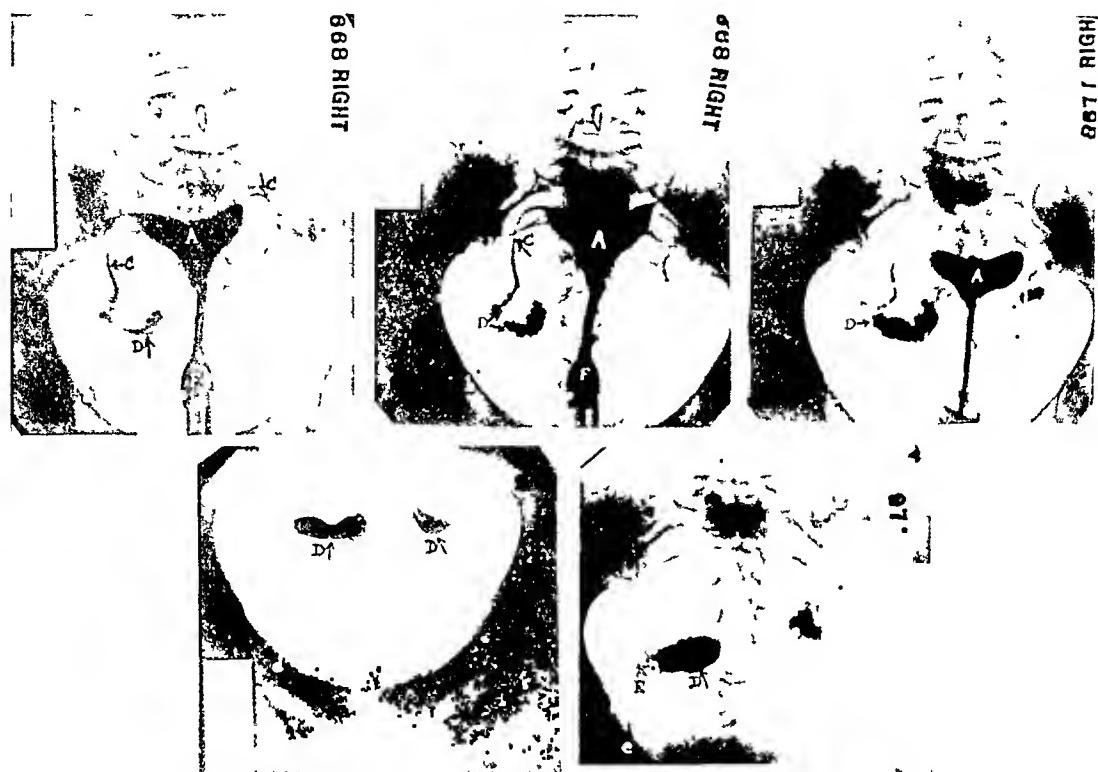
FIG. 11. Atonic uterus. (For explanation of capital letters compare with Fig. 2.)

a, b. Atonic uterus, nozzle retained in cervix.

c. One-half hour later. Nozzle has been withdrawn and a sound introduced to orient position of uterus. Because of atony of uterine musculature, oil has not yet drained off.

d. One week later. Oil is still retained in ampullae of Fallopian tubes.

e. Two months later. Oil appears to be breaking through tubes into peritoneal cavity.

Note droplet formation of oil in Fallopian tubes in this series. This condition is diagnostic of hydrosalpinx.

Patient was forty years old and complained of one-child sterility. She had been married eighteen years and had a child sixteen years prior to examination. Appendectomy at twenty-nine. Insufflation with gas three months prior to uterosalpingography made her very sick for ten days with fever and abdominal pain. Uterus was of normal size. Adnexa were thickened but not tender. Smears from meatus and cervix were negative for gonococci.

advise against its use when uterine hemorrhage is severe, there is a suspicion of pregnancy, or fever is present.

Haselhorst[23] has employed uterosalpingography in about 100 cases and found it useful for the diagnosis of inflammatory processes and uterine anomalies, investigation of the condition of the Fallopian tubes in sterility, and study of the results of operations on the tubes. He advises against its use in pregnancy and does not consider it necessary for the diagnosis and localization of uterine fibromyomata. He has observed that the normal uterus responds

fundus and into the tubes. The tubes, also, show evidence of peristalsis. Chronically inflamed tubes do not, as a rule, fill completely; but, in such cases, they may be filled if the oil is introduced under pressure.

Henkel[6] has found uterosalpingography of especial value for the diagnosis of uterine fibromyomata and their exact localization, also for the control of operative results.

Mathieu[25] has found uterosalpingography of value for the differential diagnosis between ectopic pregnancy and intraligamentous cysts.

Nahmmacher[14] reported 2 cases of
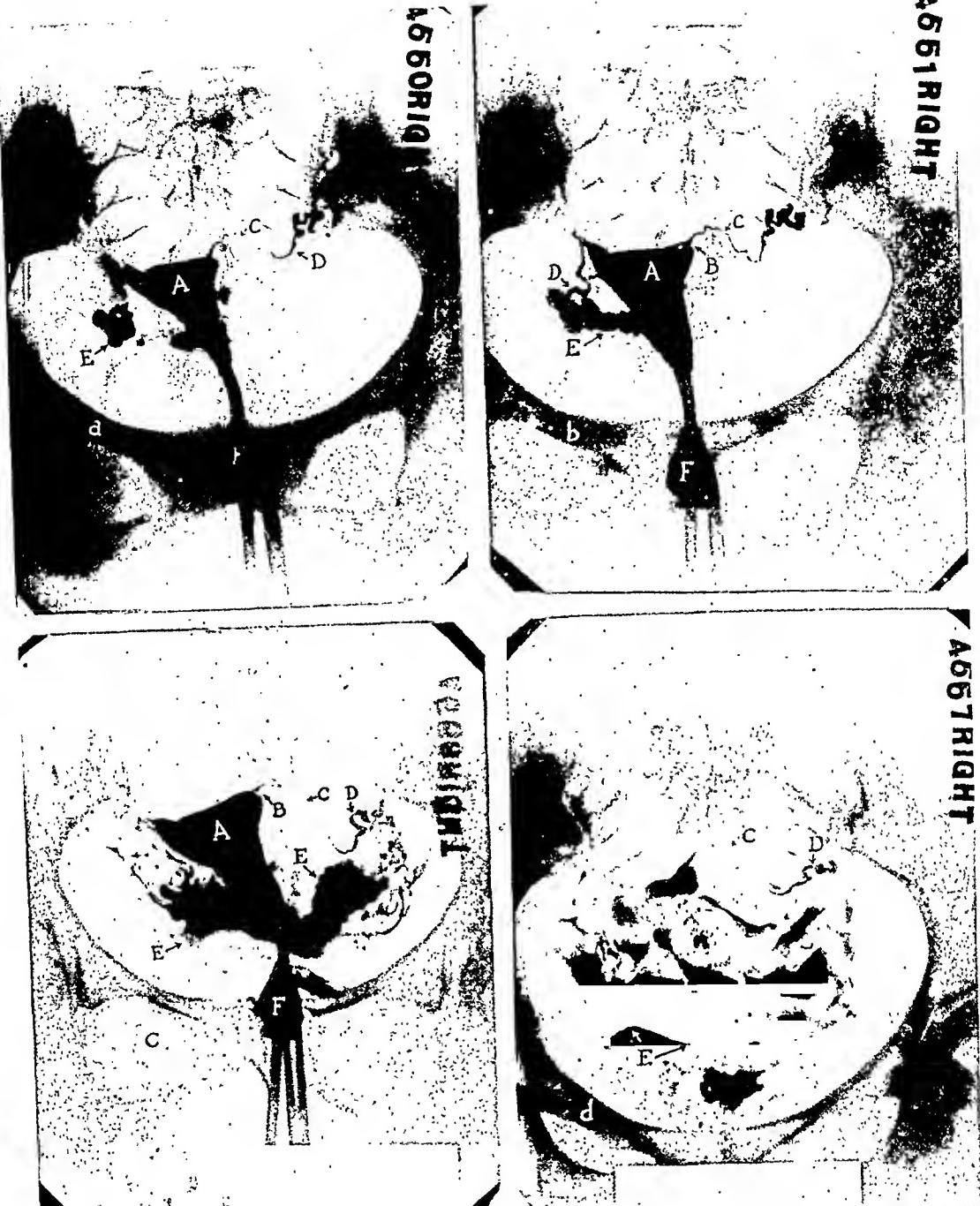
FIG. 12. Atonic uterus. (For explanation of capital letters compare with Fig. 2.)

a, b, c. Left tube is embedded in adhesions posterior to uterus. Note droplet formation of oil around it. Compare relative sizes of uterine shadows in a, b and c.

d. Distribution of oil in peritoneal cavity.

Patient was thirty-two years old, had been married fourteen years and had four children. She complained of backache and pressure in rectum. Uterus was in midposition but displaced somewhat to left. Left adnexa could be felt easily behind uterus and were sensitive to touch. Right adnexa could not be palpated.
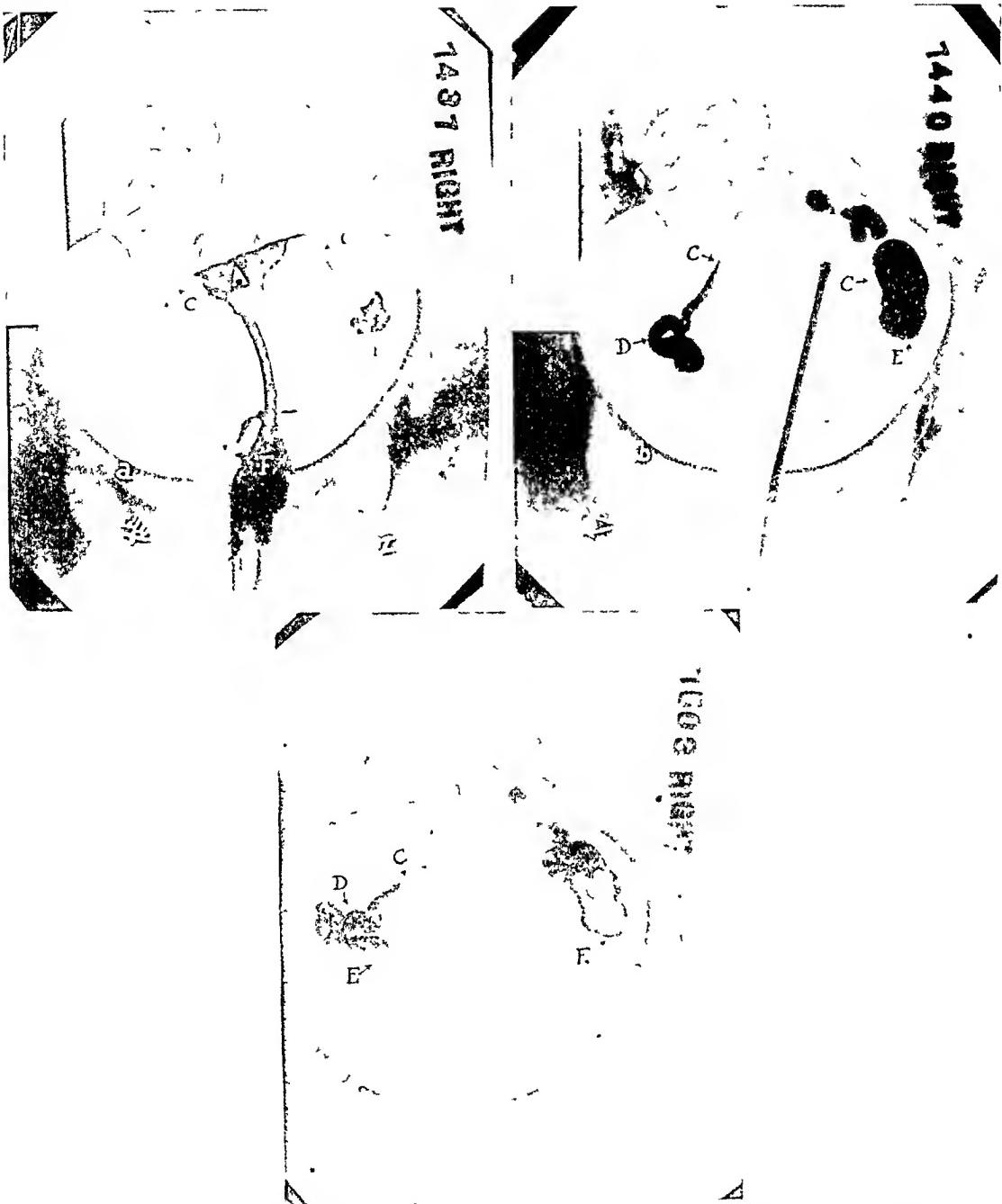
FIG. 13. Retrodisplacement of uterus. (For explanation of capital letters compare with Fig. 2.)

a. Note foreshortened vertical diameter of uterine shadow resulting from displacement. Left Fallopian tube is occluded at isthmus. Fimbriated end of right tube is held in adhesions.

b. After removal of nozzle, a sound has been introduced to orient position of uterus. Reopening of left tube at point of occlusion and droplet formation of oil in tube suggest hydrosalpinx. On right side oil has distributed itself between adhesions around tube.

c. Oil has broken through left hydrosalpinx.

Patient was twenty-eight years old and complained of primary sterility. She had been married four years. Uterus was somewhat enlarged. Anteriorly and to left of it there was a cystic mass. Laparotomy was performed twenty-four hours after uterosalpingography. Left hydrosalpinx and left ovarian cyst were found. Right tube was embedded in adhesions. There were no signs of peritoneal irritation. Postoperative course was uneventful.

Uterosalpingographic findings in this series were corroborated at operation.

urogenital fistula in which iodized oil was injected into the fistula for roentgenologic study of its course. He found that this phys. However, they do not consider the v-shaped outline of the uterine cavity as pathognomonic of uterus didelphys.
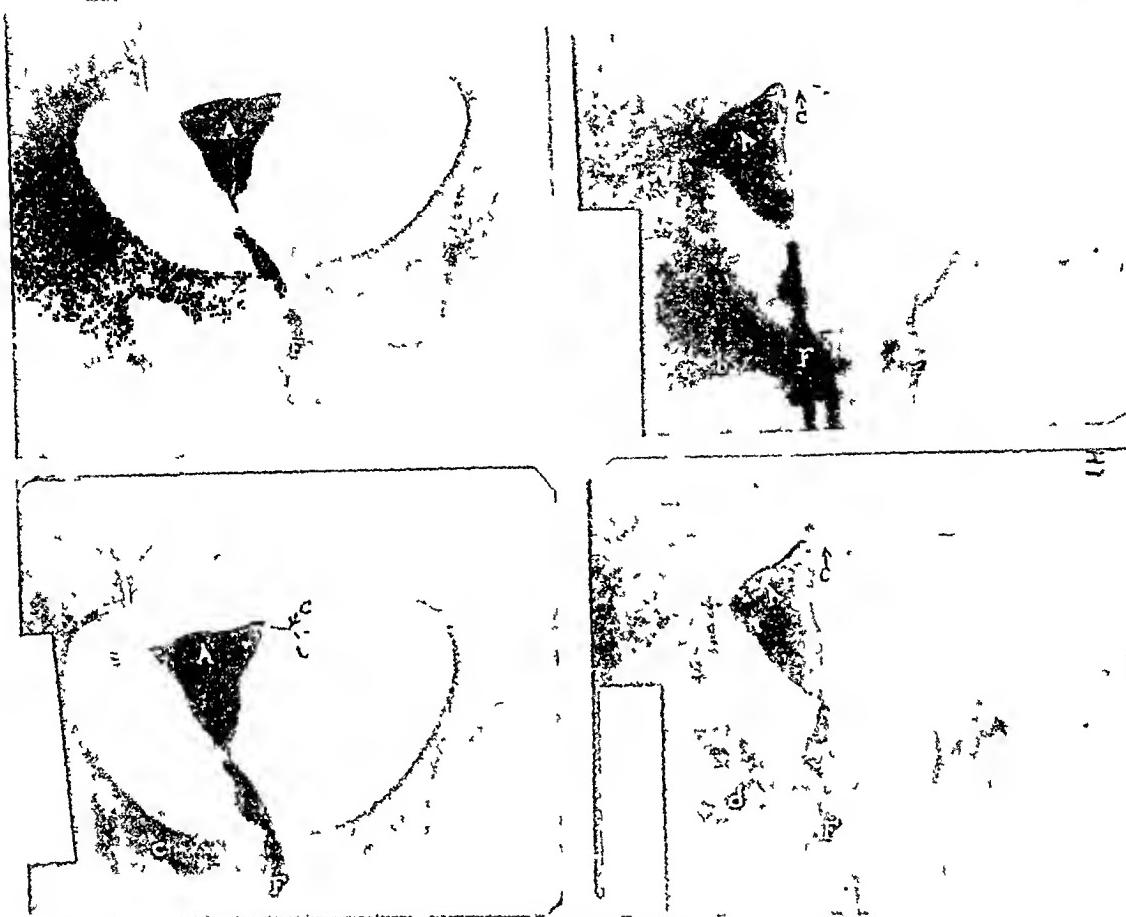
FIG. 14. Atonic uterus. Left Fallopian tube is occluded at uterine cornu. (For explanation of capital letters compare with Fig. 2.)

b, d. Lateral prone position.

A filling defect between nozzle and uterus frequently occurs in uterine displacements.

Patient was thirty-six years old and complained of primary sterility and discomfort in lower abdomen. She had been married sixteen years. Uterus was anteflexed and of moderate size. To its left there was a soft, slightly movable mass, irregular in outline. There was a cystic mass closely adherent to right side of uterus.

Following uterosalpingography laparotomy was performed. There was a right-sided broad ligament cyst closely adherent to right lateral uterine wall so as to produce slight indentation shown in uterogram. Right tube was nodular and closely adherent to cyst. Large varicose veins were found between cyst and pelvic wall. Left tube was dark and very much distended and was embedded in adhesions together with left ovary, which was cystic at its upper pole so as to require partial resection. After resection, tube was found closed at both ends. It contained 16 c c. of dark fluid, which showed no iodized oil when subjected to chemical examination. There was some free oil in peritoneal cavity, but peritoneum showed no signs of recent irritation.

Operative findings in this case corroborated occlusion of left Fallopian tube shown in salpingogram.

procedure greatly facilitates correct diagnosis in this condition and is a valuable preoperative guide. There were no ill effects.

Brocq and Béclère[30] have found uterosalpingography of value in distinguishing between uterus bicornis and uterus didel-

Petit-Dutaillis and Sorel[31] observed that injections of iodized oil may be of definite therapeutic value in cases of chronic salpingitis. They reported 1 case in which complete recovery followed two injections of the contrast medium for diagnostic purposes at an interval of several days.

They consider that the peritoneum as well as the mucosa of the uterus and Fallopian tubes possesses an extraordinary

diagnosis of pregnancy occasionally produce abortion. Yet, as they point out, this procedure may find a place in cases
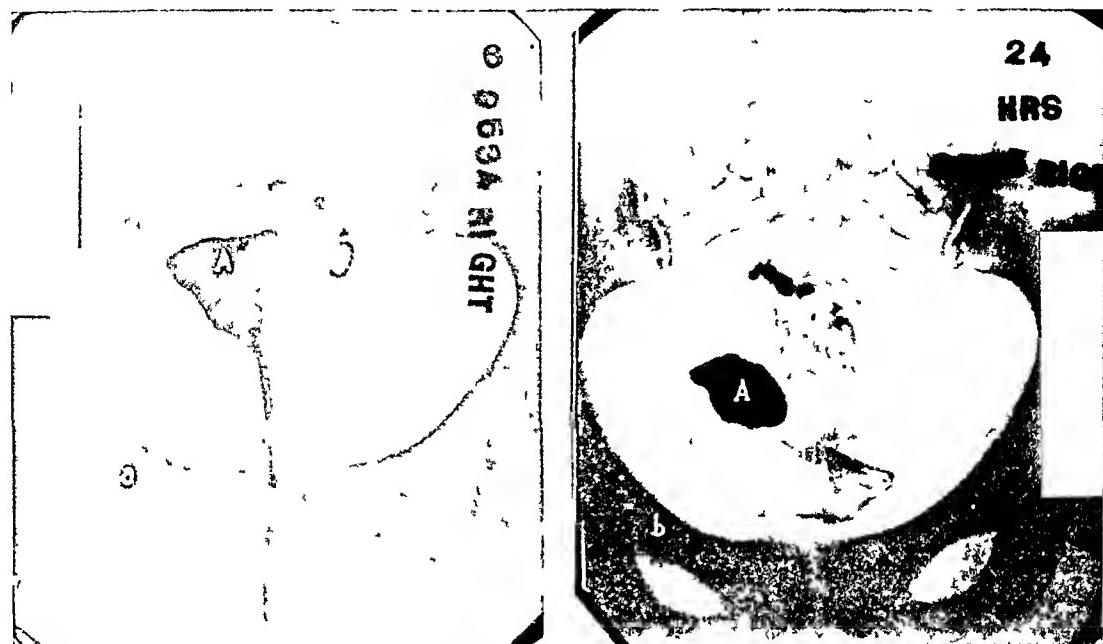
FIG. 15. Same case as Figure 14, after removal of nozzle so as to allow oil to drain off. A, shadow of uterine cavity. Oil is retained in uterus after twenty-four hours because of atony.

tolerance to iodized oil, provided that it is not introduced under forced pressure.

Francillon-Lobre and Dalsace[32] have recently reported 2 cases of sterility in young women in which no other treatment availed but injection of iodized oil for diagnostic purposes was followed by conception and normal pregnancy.

Dryoff[33] has employed colpography, or roentgenological study of the vagina after filling it with a contrast medium, in certain cases in which vaginal palpation was contraindicated, and to determine the capacity, form and tonus of the vagina, especially in pregnancy.

Mitler and Martinez[34] have observed that uterosalpingography employed for the early diagnosis of pregnancy may cause abortion. They used the method in 15 cases. While a positive diagnosis of pregnancy was made in every instance, 3 patients aborted in three to five days afterward.

Rucker and Whitehead[35] observed that injections of iodized oil to make the early

in which there is a suspicion of pregnancy and therapeutic abortion is indicated in that event.

Mocquot and Bureau[11] have used injections of iodized oil under slight pressure, controlled by the fluoroscopic screen. They found that, if the tubes are normal, the contrast medium is seen to pass through them and enter the peritoneal cavity in the form of small drops or irregular streaks.

Schultze[12] observed that when the uterus is atonic the shadow of its cavity takes a rounder shape with no sharply defined corners; also, that the tubes do not fill with the contrast medium, even though they are patent and an increased amount of the oil is injected. He has found uterosalpingography of value for the diagnosis of ovarian tumors, in which conditions the uterus is displaced from its normal position and the tube is long and shows no evidence of peristalsis. He considers it valuable also for the diagnosis of submucous fibromyomata and inflammatory
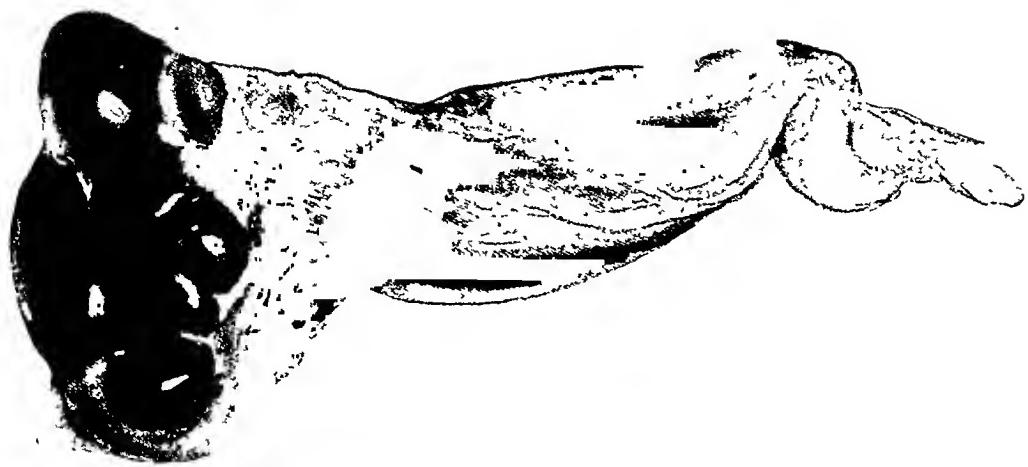
FIG. 16. Left hydrosalpinx, same case as Figures 14 and 15. At operation left Fallopian tube was found to be occluded at both ends and 16 c.c of dark fluid were aspirated. Chemical analysis revealed no iodized oil, thus corroborating uterosalpingographic findings that tube was occluded at uterine cornu.
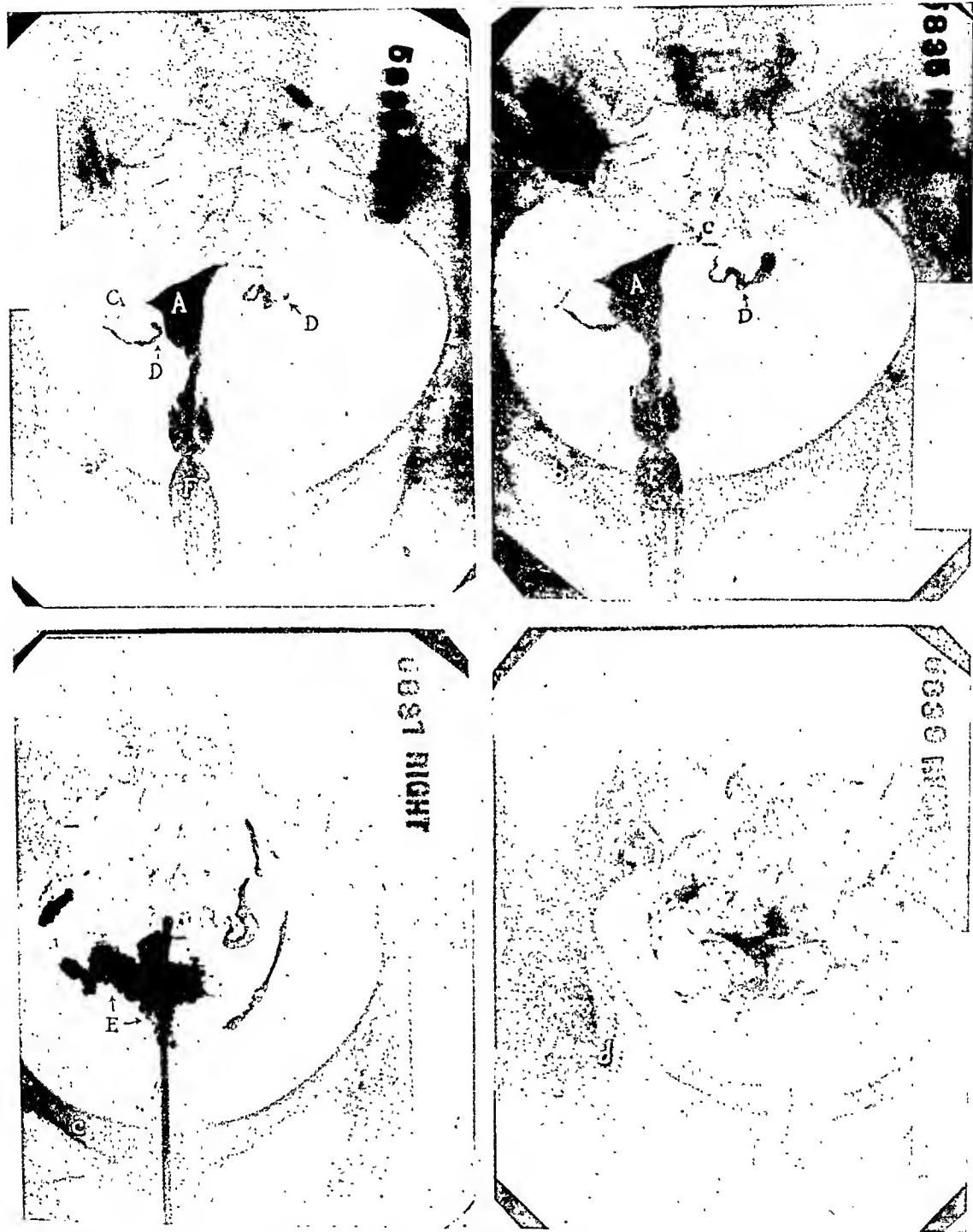
FIG. 17. Left Fallopian tube adherent posteriorly to uterus. (For explanation of capital letters compare with Fig. 2.)

a, b. Adherent tube.

c. Oil drained off and a sound introduced to orient position of uterus. Note droplet formation of oil resulting from adhesions of left tube.

d. Free oil in peritoneal cavity.

Patient was thirty-eight years old and complained of primary sterility. She had been married twice, living twelve years with her first husband and five with her second. Her second husband had two children by a previous marriage. Result of prior insufflation indicated tubal occlusion. Pelvic examination was difficult because of obesity.

processes in the tubes. Schultze has found that, when the tubes are patent, the contrast medium appears in the peritoneal

FIG. 18. Sharply anteflexed uterus. (For explanation of letters compare with Fig. 2.)

Note that vertical diameter of uterine shadow is foreshortened. There is absence of a shadow for left Fallopian tube beyond middle of isthmus, due to occlusion. Right tubal shadow is absent beyond cornua of uterus.

Patient was twenty-six years old and complained of primary sterility. She had been married five years. Shortly after her marriage her vermiform appendix and right Fallopian tube had been removed. There was a small fibroma on left side of uterus.

cavity first in the form of drops, which later coalesce to form a larger shadow. He believes that inflammatory thickening of the walls of the tubes causing diminished peristalsis may interfere with filling of the tubes even when there is no actual obstruction. The chief source of error in uterosalpingography, Schultze asserts, is insufficient filling of the uterus and tubes by the contrast material. Sufficient iodized oil must be introduced into the uterus to induce contractions, so that the contrast medium will be propelled into the tubes.

In 50 cases in which the course of the Fallopian tubes was studied by uterosalpingography, Rubin[18] found that the tube emerged from the uterine cavity in a straight course in almost every case in which the tube shadow was clearly shown. In 17 cases in which both tube shadows were visible, the intramuscular portion was clearly patent and in all but one a straight course was observed.

Schneider and Eisler,[36] in a study of the condition of the tubes by uterosalpingography, found not only definite peristalsis but evidence of a true sphincter at or near the uterine end of the tube. By the action of this sphincter the continuity of the shadow between the uterus and the tube was broken or reduced to a mere thread, or occasionally constricted as by an annular band.

Reinberg and Arnstam[37] also found evidence of such a sphincter in the uterine end of the tube. At this point there was an annular contraction of the shadow, which sometimes entirely interrupted the continuity of the shadow between the uterus and the tube, but more frequently merely narrowed and constricted it.

From examination of specimens from normal Fallopian tubes, Hermstein[38] was unable to demonstrate the presence of any true sphincter at or near the uterine end of the tube, such as some investigators have claimed is shown in uterosalpingography. In only 2 specimens out of a large series did he find evidence of a muscular spasm obstructing the lumen of the tube without any evidence of inflammatory changes.

In a study of conditions in the Fallopian tubes after intrauterine injection of iodized oil, Popović[8] found that, when the tubes are normally patent, the oil passes through the tubes in a progressive stream and small drops eventually appear in the abdominal cavity. When the tube is dilated and some secretion is present, the contrast medium does not move in this stream-like form but appears as large, round drops, which may be arranged as if strung on a thread, or may spread out and pass all at once to a definite part of the tube where they become more or less confluent. A deposit of oil may occur in the tube without preliminary formation of these large drops. This finding, also, is evidence of dilatation of the tube.

In a study of the uterus and tubes on the fluoroscopic screen and by serial radiograms during and after the injection of an opaque

substance, Gosset, Ledoux-Lebard and Béclère[39] demonstrated definite uterine contractions, the amplitude and rhythm of definitely distinguished; i.e., the two cornua and the region of the isthmus. The contractions of the cornua were more frequent and
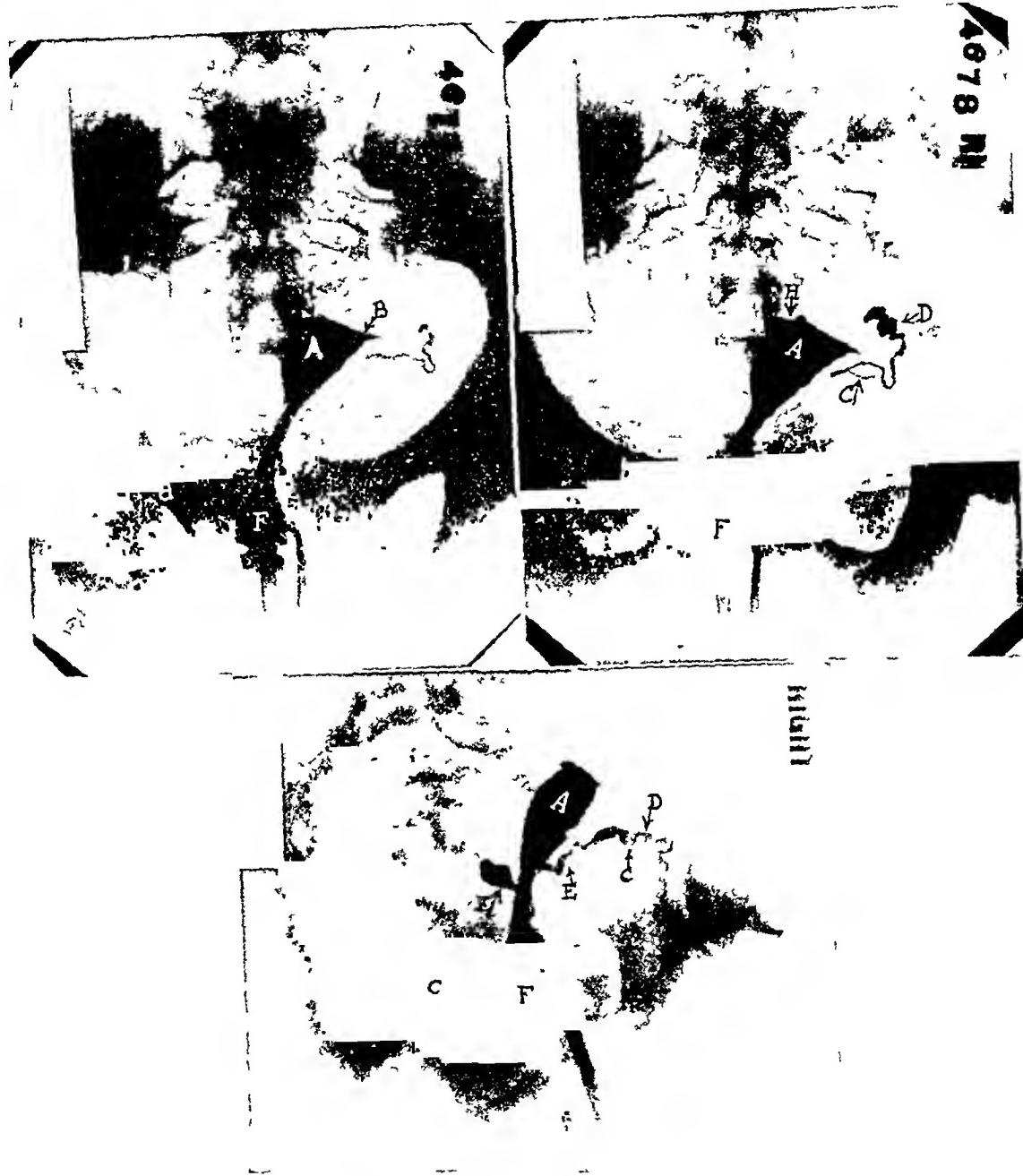
FIG. 19. Dextroverted uterus. (For explanation of capital letters compare with Fig. 2.)

There is a small fibroma at left cornu producing indentation of uterine shadow and occlusion of left Fallopian tube at isthmus.

Patient was twenty-five years old and complained of primary sterility. She had been married three and a half years. Introitus was small and cervix was conical with a pinhole os. Uterus was small, anteflexed and dextroverted. Adnexa could not be palpated. Under transuterine insufflation a pressure of 160 mm. was reached without a drop in mercury. Also, auscultation was negative, there was no shoulder pain, and roentgenologic examination did not show free air in peritoneal cavity. Several attempts to force gas through tubes were made, but all were unsuccessful.

which varied in different individuals. Three zones of contractions could be clearly defined. The contractions of the cornua originated at the extremity nearest

the tube and moved toward the center of the uterine cavity. From their study of the so-called sphincter described by Reinberg rather than in the tube. In using uterosalpingography for diagnostic purposes, it is believed, the injection of the opaque sub-

FIG. 20. Marked displacement of uterus to left and posteriorly. (For explanation of capital letters compare with Fig. 2.)

Patient was twenty-four years old and complained of inability to conceive. She had been married seven months. Ten years prior to examination, a right-sided ovarian cyst had been removed. Uterus was of moderate size but markedly displaced posteriorly and rotated to left. Insufflation with air reached a pressure of 200 mm. without a drop and all other signs of tubal patency were absent.

and Arnstam,[37] they concluded that this sphincter lies in the uterus itself, a few millimeters from the origin of the tube, stance should always be controlled by the fluoroscope in order to study the uterine contractions and avoid certain erroneous

conclusions in regard to filling defects which these contractions may temporarily simulate.

FIG. 21. Congenital procidentia, retroflexion, subinvolution and placental polyp.

a. A, shadow of uterine cavity. c, isthmus of Fallopian tube. G, defect in shadow of uterine cavity produced by placental polyp.

b. Small quantity of oil in left Fallopian tube; none in peritoneal cavity. A pressure of only 30 mm. was used in order to avoid introduction of oil into peritoneal cavity.

Patient was thirty years old and complained of backache, prolapse and occasional bleeding. She had had one child three and one-half years prior to examination and two abortions since that time, last (three months' pregnancy) two and a half months before. Cervix was long, protruding a distance of 5 cm. from vagina, and oozed blood. Uterus was size of a seven weeks' pregnancy, boggy, very tender and retroflexed.

Patient was put in knee-chest position, uterus replaced anteriorly, and ergot and pituitary extract administered for several days. It remained in place, contracted and became firm. Also, cervix no longer protruded from vagina when erect position was assumed. Bleeding occurred intermittently.

Randall[40] reported that uterosalpingography has been employed in the Mayo Clinic chiefly for the study of conditions in the Fallopian tubes.

TECHNICAL CONSIDERATIONS

The technique of employing uterosalpingography has been described in my first paper and will not be repeated here. However, there are certain items not previously mentioned to which I should like to call attention at this juncture.

Hitherto one of the drawbacks to uterosalpingography was the uncertainty of the operator at a given time with regard to the amount of iodized oil injected and its pressure.

In order that the operator may know the exact amount and pressure of the oil injected, I have devised the nozzle and syringe with manometer attachment shown in Figure 1. This apparatus, I believe, is especially useful for uterosalpingoscopy and for uterosalpingography in cases of chronic salpingitis, when it may be desirable to leave the oil in the Fallopian tubes for therapeutic purposes; also in other conditions in which it may be undesirable to force uterine contents into the peritoneal cavity.

Care should be taken that the iodized oil is perfectly fresh. A reddish discoloration indicates that it has become decomposed with the liberation of iodine. Such iodized oil should not be used.

No anesthetic is required and the patient feels none the worse for the procedure. Still the physician should insist upon absolute rest afterward. Occasionally one encounters a patient who feels faint or complains of nausea merely after the introduction of the uterine sound or the nozzle. In such cases, it is better to delay the injection for a few minutes, meantime leaving the sound or nozzle in place. If the symptoms do not abate after 0.5 c.c. of the oil

Pathological examination of tissue causing filling defect in uterine cavity (removed by curettage) showed it to be a placental polyp.

has been injected, it is better to discontinue the procedure until some other time.

Some patients are extremely sensitive observed before I had my instrument with manometer attachment. I do not know, therefore, what the pressure was. Knowing
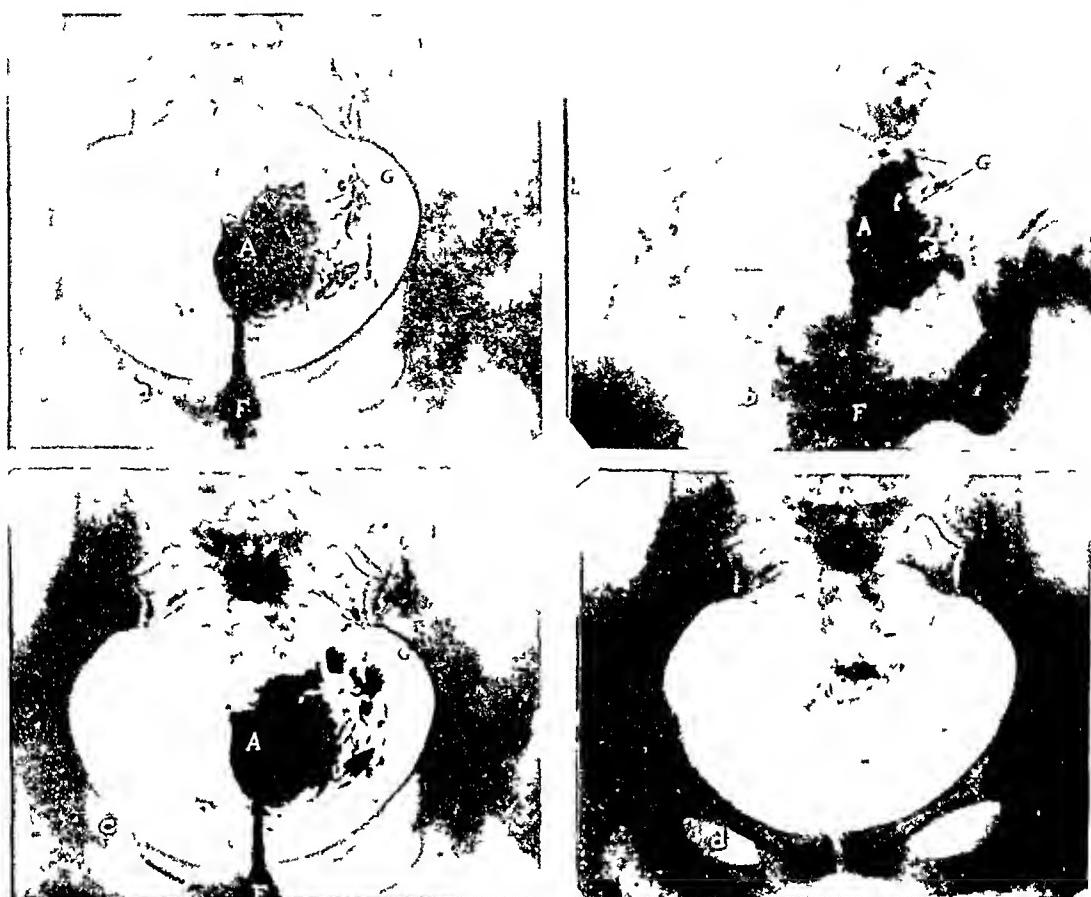
FIG. 22. Gravid uterus. (For explanation of capital letters compare with Fig. 2.) G, filling defect produced by presence of ovum.

a, b, c. Iodized oil has distributed itself between decidua capsularis and decidua vera. Mottled shadow near G is due to escape of oil between villi of decidua basalis

d. Some of oil left in uterine cavity; none in peritoneal cavity.

Patient was thirty-two years old and complained of intermittent bleeding. She had been married thirteen years and had three children, last two and one-half years prior to examination. She had had four abortions, last three and one-half years before. At twenty-five she had had an appendectomy and puncture of an ovarian cyst. Uterus was size of a two and one-half months' pregnancy and somewhat irregular. Cervix had been amputated. Diagnosis was of pregnancy with uterine fibrosis.

An injection of 12 c.c. of iodized oil under a pressure of 30 mm. was given. Twenty-four hours after injection temperature rose to 103.6°F., uterine contractions began, and several fleshy clots were expelled. On following day temperature dropped to normal but profuse bleeding continued. Curettage was performed and recovery was uneventful. Scrapings were found to contain decidua and villi.

to intrauterine manipulation. I recall the case of a woman who on two different occasions became faint and pale after the injection of the first cubic centimeter. When she was reassured, she allowed 3 c.c. more to be injected. Then, however, she complained of discomfort. When the instruments were withdrawn, she was relieved immediately. This case was

the pressure at all times with the manometer instrument, we need not fear the production of shock by excessive pressure.

The following roentgen-ray technique was employed in my observations:

Apparatus: Monex machine; J. Bentley Squier G. U. table; Bucky diaphragm; Miller Metallix X-ray tube.

Distance: 28 inches.

Voltage: 140 to 200 primary volts, according to patient's size.

Milliamperage: 20 milliamperes.

picture, whereas they may appear in their entirety in another. This apparent discrepancy is due to superimposition of shadows;

Fig. 23. Gravid uterus and multiple fibromyomata. (For explanation of capital letters compare with Fig. 2.) G, filling defect due to fibromyomata (upper) and ovum (lower).

c. Oil retained in uterus after withdrawal of nozzle.

Patient was forty years old, pregnant, and complained of cyanosis and dyspnea. She had been married nineteen years and had three children, last twelve years before. At thirty-one a therapeutic abortion had been induced because of cardiac decompensation. Cardiac condition was mitral stenosis.

Uterus was size of a two and one-half months' pregnancy and irregular in outline. Injections of iodized oil caused no ill effects. Therapeutic abortion was performed.

Exposure: 4 to 7 seconds.

Position. Stereoscopic films made in dorsal recumbent, right lateral prone and left lateral prone positions. Film in dorsal recumbent position after uterine cavity has been drained of oil, and again after twenty-four hours.

In a series of uterosalpingograms, one may find that one or both tubes may be shown only partially or not at all in one

the shadow of the Fallopian tube is eclipsed by that of the uterine cavity. Another source of confusion is rapid emptying of the tube either into the uterus or the abdominal cavity. For these reasons, one must base his deductions not upon a single film but upon a series.

DISCUSSION

With regard to priority for the use of

iodized oil in gynecology, I think the credit belongs to Sidney Forsdike,[41] of London. His paper, which was the first

to be published on this subject, was read before the Royal Society of Medicine in London on March 5, 1925. It was printed in the *Proceedings* of that society under that date and also in the *Journal of Obstetrics and Gynaecology of the British Empire* for June, 1925. Forsdike worked with lipiodol on animals and humans for two years before reporting his experiences.

Some patients with uterine fibromyomata insist upon knowing whether their reproductive functions will be maintained

if operation is performed and demand irradiation treatment instead if a negative reply is given. I recall the case of a young widow, who consulted me with her fiancé and said that she would break her engagement unless assured that it would be possible for her to conceive. Other women wish to be informed whether their tubes and ovaries were removed at previous
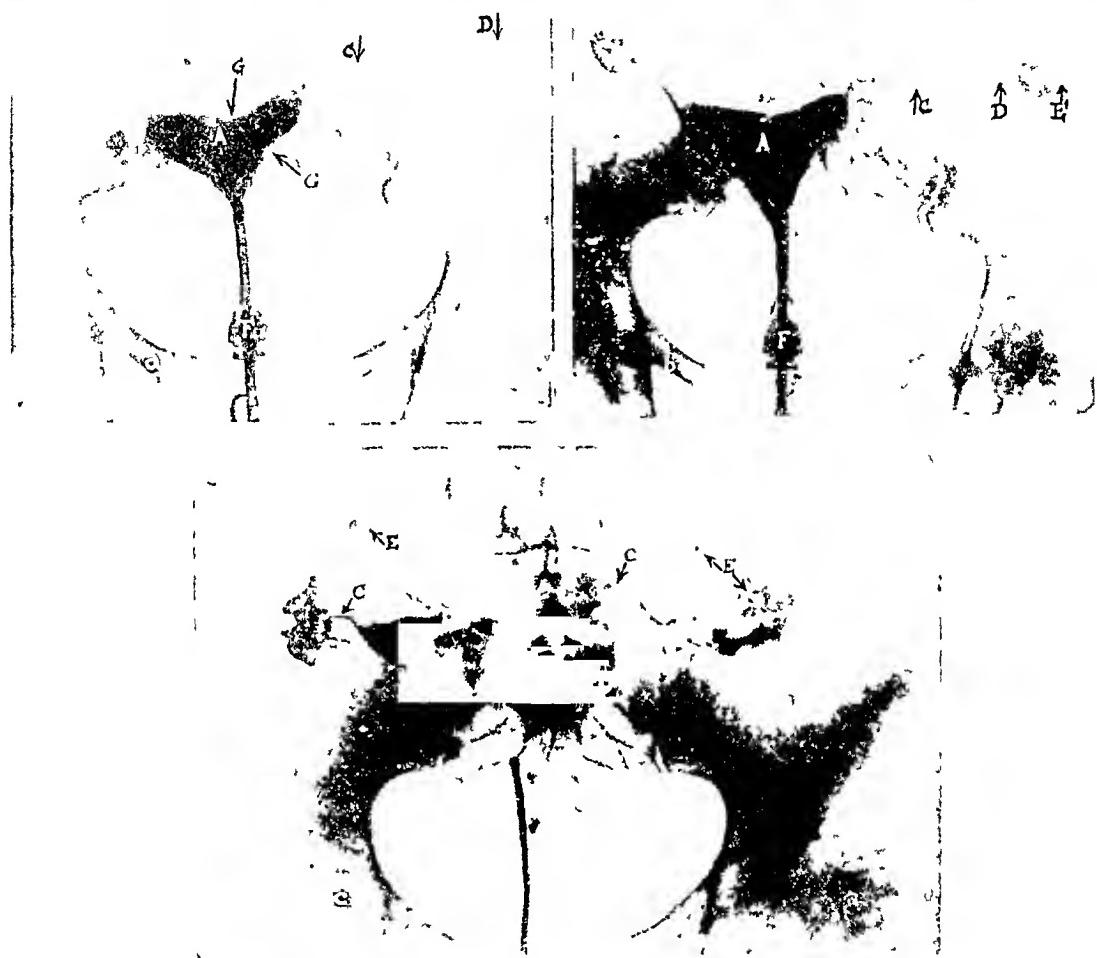
FIG. 24. Multiple large fibromyomata; patent Fallopian tubes; atonic uterine cavity. (For explanation of capital letters compare with Fig. 2.)

a. Indentation G is produced by multiple fibromyomata.

Patient was thirty-eight years old and complained of a backache and a heavy feeling in lower abdomen. She had been married twenty years and had three children and one abortion. Menstruation occurred every three weeks and was followed for many days by staining. Uterus was found to be much larger than at an examination eleven years previously. There were a large number of fibromyomata, some of which were pedunculated. A hemic murmur was heard at the base of heart.

operations. In such cases uterosalpingoscopy may help materially with regard to prognosis.

quent pregnancies as compared with those after insufflation of gas. My belief, however, is that it will eventually prove to be
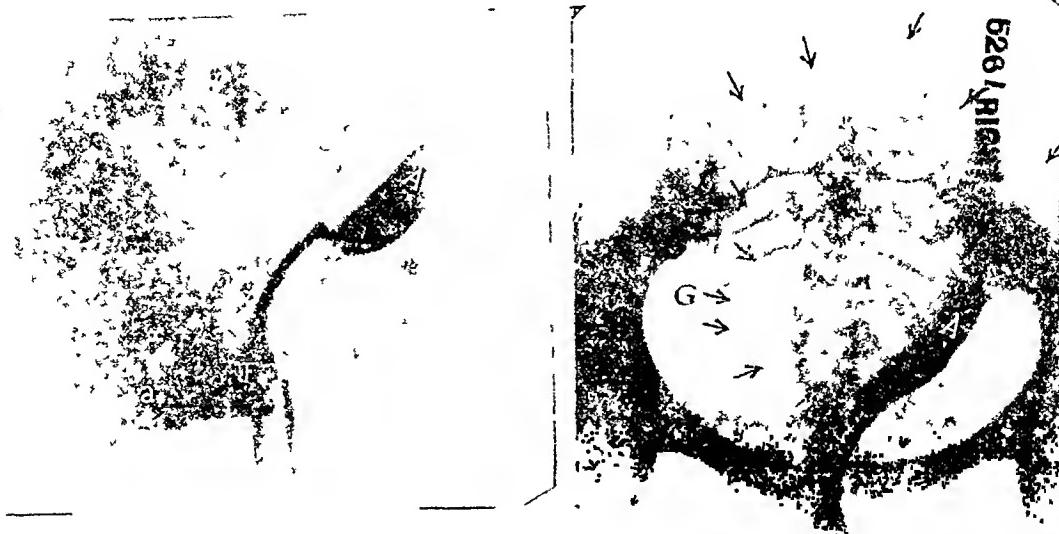
FIG. 25. Multiple large fibromyomata of uterus. (For explanation of capital letters compare with Fig. 2.)

Arrows (G) outline tumor, which is flattening and displacing uterus.

Patient was thirty years old, married twelve years, and had two children. Her illness dated back six months and was manifested by progressive increase in size of abdomen, severe backache and pressure symptoms. Uterus was size of a three and one-half months' pregnancy. Twenty-four hours after uterosalpingography, supravaginal hysterectomy was performed. No free oil or sign of peritoneal irritation was found. Recovery was uneventful.

In some cases the uterus accommodates a larger amount of oil and the uterogram is larger than one would expect from the findings on palpation. This condition is due to atony of the uterine musculature. When uterine tone is good, the organ empties itself of the oil within a few seconds of the time when the nozzle is withdrawn. In cases of uterine atony, emptying is materially delayed. Figure 15 shows retention of the oil for twenty-four hours, due to atony.

A characteristic finding in hydrosalpinx and conditions in which the Fallopian tube is held in adhesions is a droplet formation of the oil. This finding is well shown in Figures 11, 12, 13 and 17. Figure 6 shows how iodized oil, squirted from a syringe into a glassful of water, sinks to the bottom and arranges itself there in droplet formation.

With regard to the correction of sterility by uterosalpingography, I cannot as yet state the percentage incidence of subse-

greater, because the iodized oil not only holds the occluded tubes patent for a longer interval but may also facilitate absorption of old inflammatory lesions.

In some of my cases uterosalpingography gave evidence of therapeutic as well as diagnostic value. It helped to relieve tubal occlusion, dilate stenosed tubes and overcome states of tubal inflammation.

Although iodized oils would appear to have therapeutic value in the Fallopian tubes, we do not know to what factor this virtue should be attributed. I performed some experiments which indicate that we cannot ascribe it to any direct antiseptic power of the oil. In bacteriologic studies with lipiodol and iodipin, I found that dilutions of 1:200, 1:100 and 1:50 had no direct antiseptic effect upon cultures of staphylococcus or Bacillus coli. Additions of iodized oil to the culture media in these dilutions failed to inhibit the growth of the microörganisms after twenty-four and forty-eight hours.

The slow liberation of iodine may be a factor for therapeutic good, or possibly the mere presence of the innocuous oil serves to
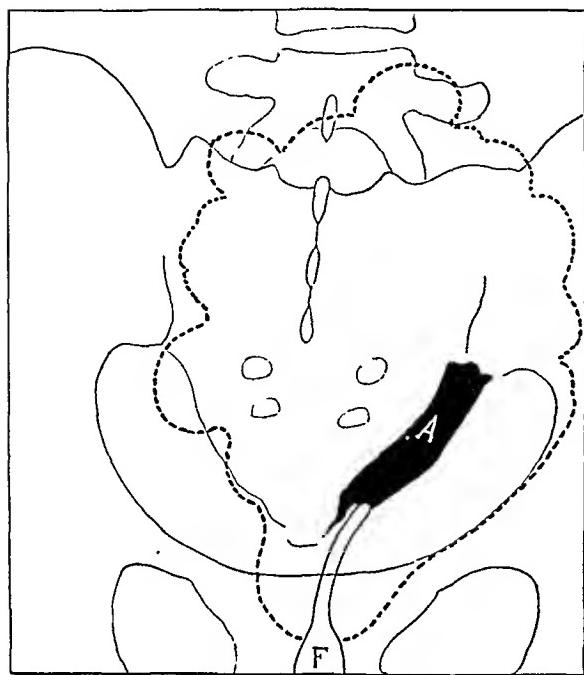
FIG. 26. Diagram from same case as Figure 25. (For explanation of letters compare with Fig. 2.) Dotted line shows outline of fibroid uterus.

stimulate the resisting mechanisms. Further study is needed with reference to the therapeutic application of uterosalpingography and its explanation.

Sometimes the iodized oil accumulates around the ampulla, making it impossible to determine whether it lies in the dilated ampulla of the tube or is held there by old adhesions in a pocket of peritoneum. The differentiation can be made only after repeated roentgenograms are taken over a period of twenty-four hours or perhaps several days.

One must not be too hasty to conclude that the tube is occluded because the oil does not enter the peritoneal cavity readily. Sometimes there is a club-shaped shadow in the course of the tube with no free oil in the peritoneal cavity; but, when a little more oil is injected and more roentgenograms are taken, a continuation of the tube and the entrance of free oil into the peritoneal cavity can be observed.

It is interesting to note that the salpingogram may show a distinct pathological process, notwithstanding the fact that the Fallopian tubes appear perfectly normal on palpation. For example, there may be interrupted filling defects in the tube, giving it a knobby appearance. This appearance is often due to perisalpingitis.

If careful attention is paid to complaints of discomfort, rupture of the tube should never occur unless undue force is employed. The use of the instrument with manometer attachment makes this accident extremely unlikely. If the patient complains of discomfort, the injection should be stopped until the pain abates. It may be due only to uterine or tubal stretching, or to contraction of the uterus.

While there is a theoretical possibility of carrying infected contents of the tubes into the peritoneal cavity by uterosalpingography, I believe that this danger is less than when insufflation of gas is employed. The gas is more likely to carry undiluted infectious material over a larger area in the peritoneal cavity, possibly reaching as high as the subdiaphragmatic space. The oil, on the contrary, mixes with and dilutes such infectious material as may be present. Rapid absorption of large quantities of infectious material is therefore much less likely.

CONCLUSIONS

1. Recent investigations have corroborated the diagnostic value of uterosalpingography and greatly increased the scope of this procedure.

2. Properly employed with an aseptic technique and in selected cases, the injection of iodized oil for roentgenological visualization of the uterus and Fallopian tubes is entirely harmless.

3. The contraindications to uterosalpingography include pregnancy, unless therapeutic abortion is contemplated; gonorrhea and acute tubal inflammation; malignant growths of the uterus, because of the danger of carrying the cancer cells into the peritoneal cavity; and menstruation and profuse uterine bleeding.

FIG. 27. Enormous uterine fibromyoma differentiated from ovarian cyst by uterosalpingography. (For explanation of capital letters compare with Fig. 2.)

a. Arrows outline tumor. This was an ordinary roentgenogram, which suggested that growth was an ovarian cyst.

b. After injection of iodized oil, filling defect in uterine cavity suggested fibromyoma as nature of growth.

c. After withdrawal of nozzle, some of oil was retained in uterine cavity.

Patient was thirty-five years old, married nine years, and had two children. A pelvic growth was observed during her first pregnancy. There was rapid growth in size of tumor during last six months. Abdominal and pelvic examination revealed a smooth cystic growth filling pelvis and extending above umbilicus. Uterus could not be mapped out.

Laparotomy twenty-four hours after uterosalpingography disclosed an enormous uterine fibromyoma. Supravaginal hysterectomy and left salpingo-oophorectomy were performed. No fresh adhesions or signs of peritoneal irritation were found. Recovery was uneventful.

4. The injection of iodized oil is of therapeutic value in cases of chronic salpingitis and may sometimes avoid the necessity of operations on the Fallopian tubes for sterility.

5. Even when the diagnosis of a gynecologic condition can be made without the aid of uterosalpingography, this procedure adds a decided element of exactness as to the localization and extent of the lesion.

6. A new syringe with manometer attachment is described, by which the operator can know at any time the amount of oil injected and its pressure.

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LIPIODOL AS A DIAGNOSTIC AID
IN FIBROMATA OF THE FEMALE GENITAL TRACT*

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THE value of lipiodol as a diagnostic aid in gynecology has been well substantiated. In competent hands, this method of visualizing cavities of the genital tract has been proved to be an artful aid, sufficiently free from harm to be of real practical value. Its *raison d'etre* is as rational as that of the visualization of the urinary tract; the frequency of genital abnormalities in the female gives it much academic as well as practical value. Notwithstanding these facts, this aid to gynecological diagnosis has not been sufficiently used to establish mass information or reliable acumen in reading the roentgenograms; hence, any new material should be welcome. The willingness of the female patient to submit to operation and the interest of the surgeon in operation should not stand in the way of our best efforts toward exactness in preoperative gynecologic diagnosis. The following cases are illustrative:

A single woman, aged twenty-two, presented the classic picture of ectopic pregnancy; exposure, missed period with uterine bleeding three weeks later, and a doughy, rather fixed, mass in the region of the right tube. By means of lipiodol, the cavities of both tubes were visualized and shown to be normal. Because of the fact that at a previous operation the right ovary had been removed, the diagnosis of intraligamentary cyst was made and the indication for operation was changed from an emergency to that of one of election. Later, the diagnosis of intraligamentary cyst was proved at operation.

In another case, that of a young girl of fifteen, who had had an amenorrhea of five months and a mass in the lower abdomen, just the shape and size of a five months' pregnancy, lipiodol proved extremely useful. This patient's mother had been told by the interne that her daughter was pregnant. I saw this patient the following day and on bimanual examination made out a small mass in the right side of the pelvis, which seemed to have been pushed up near the symphysis by the larger mass. I felt that this might be the infantile uterus. The patient absolutely denied the possibility of pregnancy, no fetal heart could be heard and no fetus could be palpated. The cervix was small and showed no signs of pregnancy. The uterus was then very carefully sounded and found to be of less than normal depth. Lipiodol was then injected and the skiagram showed the uterus to be infantile, both tubes filling normally, and the uterus pushed considerably to the right side. The temperature record, the white blood cell count, and the sedimentation test pointed toward abscess, and this diagnosis was made and proved at operation.[1]

Two applications of this method of diagnosis seem to be missing from the literature; the one, of visualizing fibromata in the vagina, uterus and pelvis, and the other, of the prognostic value of this method in subacute and chronic salpingitis. Out of a mass of material collected from the injection of 150 patients under my supervision,[2] I submit 6 cases of fibromata of the female genital tract visualized by lipiodol and the roentgen ray. The question of the use of lipiodol as a prognostic aid in salpingitis will be discussed in a subsequent paper.

CASE REPORTS AND DISCUSSION OF ILLUSTRATIONS

CASE I (Fig. 1). This patient, aged nineteen, came to the hospital in October, 1927, with a condition in which differentiation between appendicitis and right salpingitis was difficult.

[1] This patient was from the service of and was operated upon by Dr. Raymond Watkins.
[2] Some of this material has been reported in *Northwest Med.*, 27: 222, 1928.

This skiagram, taken after the injection of lipiodol, showed a normal uterine cavity (there is a defect on the right side, due no doubt, to

FIG. 1. Skiagram of Case I, shown, primarily, as one of normal uterine cavity and tubes to be used as contrast in the plates that follow.

the cannula) and normal tubes. A constriction in the tubouterine junction on each side was

FIG. 3A. Case III. Skiagram showing elongated uterine cavity and large crescent-shaped filling defect. Uterine fibroid.

also seen. (This has been described by Rubin as caused by sphincteric action). The patient was operated on the same day, with a diagnosis

of subacute appendicitis, disease of the right tube having been eliminated by the roentgen ray. The appendix was found considerably

FIG. 2. Case II. Skiagram showing tumor with pedicle.

swollen and inflamed. She made an uneventful recovery, became pregnant in three months, and within a year after the injection of lipiodol I delivered her of a normal living baby, weigh-

FIG. 3B. Case III. Photograph of the specimen after a supravaginal hysterectomy, showing the uterine cavity and the large fibromyoma, cut into.

ing 3395 gm. This case suggested that the use of lipiodol in the tubes does not jeopardize the chance of future pregnancy.

Here, then, is a case in which injection of lipiodol was an aid in the differential diagnosis between right salpingitis and acute appendicitis; in which a constriction, probably

sphincteric, is shown in both tubouterine junctions and in which a pregnancy and delivery of a normal baby ensued within the year.

FIG. 4A. Case IV. Skiagram showing elongated lower uterine segment and large concave filling defect. Multiple fibroids of uterus.

FIG. 5A Case V Skiagram.

CASE II (Fig. 2). This patient, aged forty-three, complained of metrorrhagia and loss of strength for two years and recently of a foul, blood-tinged leucorrhea. Examination revealed a round, hard mass filling the pelvis, as does a baby's head. The fingers could not be passed around the tumor, and no attachment could

be felt. Lipiodol was injected all around the tumor with a soft rubber catheter, and the skiagram (Fig. 2) visualized the tumor with its

FIG. 4B. Case IV. Photograph of specimen removed.

pedicle, which I presumed was attached inside the uterus.

The tumor was delivered through the vulva, as a baby's head would be, with a pair of obstetrical forceps. When the pedicle was exposed, it was clamped and the tumor was amputated. The pedicle was closed with a continuous suture of chromic catgut. The uterus

FIG. 5B. Case V. Pathological specimen. Fibromata of ovary.

was so inverted as to be almost saucer shaped. The cervical wall was about 3 cm. in thickness and the cervical opening was about 7 cm. in diameter. The eversion could not be reduced

by pressure and was apparently one of long standing. The patient made an uneventful recovery, and when seen six months after the

ing-down sensations. The pelvic examination was negative, except for the fact that the corpus of the uterus was approximately three
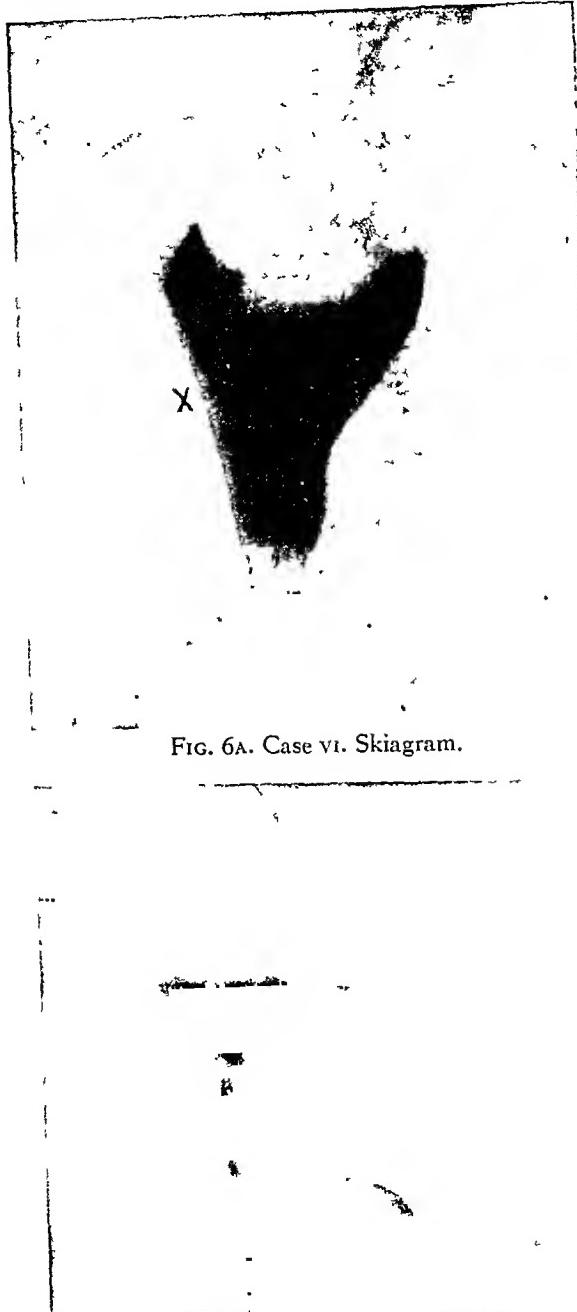
FIG. 6A. Case VI. Skiagram.

FIG. 6B. Photograph of specimen after supravaginal hysterectomy and removal of right adnexa showing pedunculated fibroid and ovarian cyst.

times the normal size, and extremely hard. The skiagram (Fig. 3A) after oil injection showed considerable elongation of the uterine cavity with a large crescent-like filling defect. Diagnosis by skiagram: uterine fibroid.

CASE IV (Figs. 4A and B). The patient, aged fifty, complained of a tumor in the abdomen which was slow growing and gave

FIG. 7A. Case VII. Skiagram.

PLATE 7B. Photograph of specimen removed, showing the cyst of left ovary and pedunculated fibroid. (Note how pedunculated fibroid causes widening of lower uterine segment in skiagram, Figure 7A.)

operation, the uterus was gradually returning to normal shape, and the patient was free from bleeding and discharge. The pathological diagnosis was pedunculated submucous fibromyoma with hyaline degeneration and secondary chronic inflammation.

CASE III (Figs. 3A and B). This patient, aged forty-eight, complained of uterine bleeding, a feeling of weight in the pelvis, and bear-

her considerable distress because of weight. The top of the growth could be palpated at the level of the umbilicus, and because of thick abdominal fat, the exact nature of the growth could not be ascertained nor could the corpus of the uterus be exactly located. A mass about the size of a normal uterine corpus could be felt just above the cervix to the right. The skiagram (Fig. 4A), following the injection of lipiodol, shows an enormous elongation of the lower uterine segment, and a large concave fill-

ing defect on the left side of the uterine cavity. Diagnosis: multiple fibroids of the uterus.

A photograph of the specimen (Fig. 4B) after supravaginal hysterectomy, shows that the mass near the cervix which I thought might be the fundus was one of the multiple fibromyomata of the uterine corpus. The crescent-like filling defect is explained by the large fibromyomata shown in the opened specimen.

CASE V (Figs. 5A and B). In this case[3] as illustrated the lipiodol appears to have been injected with more than the usual force, and is scattered rather widely in the pelvis. The tumor is clearly outlined. The oil, being warm and thin, readily accommodates itself to the outer surface of a growth on which it falls. The uterus is seen sharply antiflexed. The fimbriated end of the tube apparently lies near the top of the tumor. Diagnosis: fibromata of the ovary.

CASE VI (Figs. 6A and B). This woman, aged thirty-five, complained of almost constant blood-tinged spotting with no other ill-health. Bimanual examination was negative except that the uterine corpus was larger than normal, and there was felt a mass in the right adnexa which felt like an ovarian cyst the size of a hen's egg. After injection of lipiodol, the skiagram (Fig. 6A) revealed (1) a widening of the lower segment of the uterine cavity, (2) a concave filling defect in the fundus of the uterine cavity, and (3) at the point marked "x" (the original film showed this plainly) another filling defect with the concavity upwards, of the sort one would expect to find at the lower pole of a pedunculated fibroid. A diagnosis of pedunculated fibroid was made.

CASE VII (Figs. 7A and B). This patient, colored, aged twenty-six, complained of almost continuous uterine hemorrhage for twenty days, following seven weeks of amennorrhea. During the last two weeks of this time she had nausea and vomiting and cramp-like pains in the left lower quadrant. Examination: There was free blood in the vagina and the cervix was slightly softened. The corpus of the uterus was anterior and slightly enlarged. There was a mass palpable in the left adnexa approximately 6 cm. in diameter and fluctuating. The history pointed definitely to ectopic pregnancy but the mass felt like an ovarian cyst. After the injection of oil, the skiagram (Fig. 7A) showed (1) marked evidence of disease of both tubes with almost complete obliteration of the

[3] This patient was from the service of, and was operated on, by Dr. Raymond Watkins.

right tube, (2) a marked widening of the lower segment of the uterine cavity (cf. Fig. 1), (3) a filling defect near the fundus of the uterus on the right side. This was the first of its kind that I had seen, and I was unable to account for the widening of the lower segment and the filling defect. At operation there was found bilateral subacute salpingitis, a cyst of the left ovary and multiple fibroids of the corpus of the uterus.

Both tubes, the cyst of the left ovary, and the corpus of the uterus were removed. This patient had a temperature of 100°F. for several days but left the hospital on the twentieth day in excellent condition.

Pathological diagnosis: sub-acute purulent salpingitis; simple cyst of the ovary; pedunculated submucous fibromyoma with secondary chronic inflammation and multiple intramural fibromyomata.

SUMMARY

The presence of fibroids in the uterus is nearly always indicated by a deformity of the uterine canal.

The presence of intrauterine pedunculated fibroids can be ascertained by the shadow of the tumor itself and by the distortion of the uterine canal and the filling defects.

Intravaginal tumors may be outlined by the iodized oil and intra-abdominal tumors may occasionally be visualized in the same way.

In cases of large submucous myomata the uterine cavity often takes the shape of a crescent and in multiple tumors of the uterus the cavity is visualized in irregular form and sometimes enormously enlarged.

Since myomectomy is the procedure of choice in all but the exceptional case where the woman is under forty, it will seem important to be able to foresee, at least in a certain measure, the possibility of a conservative operation. Radiologic exploration of the uterus after the injection of iodized oil, in case of myomata, gives one a clear view of the relationship between the myomata and the cavity of the uterus and also establishes the fact as to the permeability of the tubes. This last fact is of importance since one would not want to conserve the uterine corpus unless the tubes were permeable.

FIFTH AVENUE HOSPITAL CLINICS
ROUTINE TREATMENT FOR PREOPERATIVE AND POSTOPERATIVE SURGICAL CASES*

THE mere suggestion of routine orders or standard treatments usually produces a shower of protests and only too often with justification. But in the average general hospital, where the Intern Staff is changing frequently, it is almost essential to have some basis for work.

With this in mind, the following regulations have been made for the use of the Staff to cover the preliminary treatment of certain types of cases admitted to the ward. However, it is emphasized that these rules are not inflexible and that individual cases should have individual orders. Also that these regulations are subject to revision at frequent intervals.

On discharge from the hospital, we have found it necessary to give each patient written instructions in regard to his diet, exercise and special treatments, as too often verbal advice is misunderstood or forgotten. Our follow-up results have been found much more satisfactory when patients have received written instructions and many of the worries and often the failures of convalescence have been overcome in this way.

It is our hope that in presenting these routine admission instructions and the regime and diets for convalescents, we will obtain suggestions and criticisms from other clinics and aid in establishing a standard which can be adopted by other Surgical Services.

PREFACE[1]

In a complex organization like that of a hospital, it is not always easy for the different members of the working force to get a clear idea of their duties. This particularly is the case in respect of those tasks that present themselves at irregular or long intervals of time. Customs spring into existence without the knowledge of those in authority and assume the authority of law in the absence of a definite statement that is easily accessible.

To help the House Officers in an understanding of their functions, this compilation of rules has been made. From time to time some shifting of old tasks and apportionment of new duties will be necessary. These assignments will be made by the Medical Board of the Hospital. The rules are numbered serially, certain numbers being omitted to allow for the introduction of new rules. Additions and revisions will be made by means of gummed slips which are to be pasted in their proper place. These rules are designed for male interns. Whenever there are female members of the House Staff, the head of the division concerned will make such readjustments in the rulings as may seem desirable.

The reputation of the hospital depends largely upon the interns. It is they who have the first contact with patients and with patient's friends. Furthermore the circumstances at this first meeting are often very trying. Someone is really or supposedly very ill, his friends are much discouraged or are in panic. The House Officer should remember that this nervous tension, often coupled with a very defective knowledge of English, makes the patient and his family and friends seem most unreasonable. He should remember also that he is the representative of a dignified and altruistic organization and that he is under peculiar obligation to be humane and patient and kind to the exclusion of all appearance of being annoyed, no matter how aggravating the circumstances. The standing of the hospital in the

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community is based largely upon the impression made at these first meetings and it is of the greatest importance that the name Fifth Avenue Hospital should connote courtesy to all, even to the discourteous, and most painstaking care of all who are ill.

ROUTINE TREATMENTS FOR SPECIAL TYPES OF CANCER

1. *Traumatic Cases.*
   a. Treatment for shock.
   b. Examination of extremities and bony parts for fractures.
   c. Examination of abdomen for ruptured viscus.
   d. Neurological examination, for paralysis.
   e. Roentgen-ray as soon as possible, if necessary.

2. *Routine in Fracture of Skull.*
   Treatment for Shock.
   a. Get roentgen-ray as soon as possible.
   b. Elevate head of bed.
   c. Ice cap to head of patient.
   d. Clean up bleeding from ears and turn patient onto that side so that drainage is assured. *Do not plug up external auditory canal.*
   e. Record pulse and B.P. q ½ h.
   f. Routine eye and neurologic consultation, but interns are to examine patients for symptoms referable to the systems themselves.
   g. Spinal tap on attending order.
   h. Do not forget there may be other injuries; examine carefully and record findings.

3. *Treatment of Extensive Burn Cases.*
   All extensive burn cases are to be sent directly to the wards and not treated in the clinic. Upon arrival on the ward they are to be treated for shock. (Apply heat and as soon as possible get them under an electric light tent.) Force fluids, carbohydrates. Daily colonic irrigation, clysis if necessary. Intern should remove all loose skin and blisters and clean skin around burned areas with benzine and alcohol. Wet dressings of 5 per cent tannic-acid solution should then be applied to burned areas and kept wet for twenty-four hours. If burns are on face, use tannic-acid ointment. Blood chloride examination made 2 days. Chart intake and output.

4. *Non-Operative Pelvic Infections and Peritonitis.*
   a. Exaggerated Fowler's position.
   b. Ice bags to pelvis.
   c. B.i.d. hot colonic irrigation.
   d. Hot soda bicarbonate douche daily between colonics.
   e. Force fluids, general diet.
   f. Daily non-lob.
   g. Narcotics liberally.
   h. Blood typing P.R.N.

5. *Drainage of Wounds.*
   Attention is called to the fact that when combines are used as an outside dressing on drained wounds, the underneath gauze must be inspected frequently and changed whenever it becomes soiled. Combines are not as absorbable as plain gauze, hence the underneath gauze may become saturated without the combine being stained.

6. *Dressings.*
   Except in the case of emergency, dressings on the floor are to be done by the Intern on duty before he goes to the operating room in the morning.

7. *Routine Postoperative Treatment.*
   The following data are furnished for your information to guide you as to when certain procedures are carried out. This naturally presupposes that there are no contraindications in any of these procedures and, should any develop, individual instructions will be given for each case.
   a. Michel clips are to be removed on the 5th postoperative day.
   b. Silk skin stitches are to be removed on the 5th postoperative day.

c. Upper abdominal non-absorbable sutures are to be removed on 10th postoperative day.

d. Lower abdominal non-absorbable sutures are to be removed on the 7th postoperative day.

e. Patients with the postoperative diagnosis of chronic appendicitis for which appendectomy has been performed through a McBurney incision are to be allowed out of bed on the 6th postoperative day.

f. If the appendectomy was performed through the right rectus, patient to be allowed out of bed on the 8th day postoperative.

g. Patients with the postoperative diagnosis of inguinal hernia are to be allowed out of bed on the 11th day postoperative.

h. Patients upon whom pelvic operations have been performed through a Pfannenstiel incision are to be allowed out of bed on the 8th day postoperative.

i. Patients upon whom operations have been performed through right rectus or midline suprapubic incision are to be allowed out of bed on the 9th day postoperative.

j. Patients with postoperative diagnosis of chronic appendicitis only are to be discharged on the 9th day postoperative.

k. Patients with the postoperative diagnosis of inguinal hernia are to be discharged on the 13th day postoperative.

l. Patients upon whom operations have been performed through right rectus, Pfannenstiel or midline suprapubic incisions are to be discharged on the 11th day postoperative.

m. Perineorrhaphy, and trachelorrhaphy cases are to have vaginal irrigations on 2nd postoperative day; then q 2 days therafter.

n. Perineorrhaphy and trachelorrhaphy cases are to be allowed out of bed on 10th postoperative day, discharged on the 12th postoperative day.

o. Rectal cases to be allowed up on the 3rd postoperative day and discharged on the 5th postoperative day.

p. D. & C. Routine.
(a) Examine for and remove all packing on 1st morning postoperative.
(b) Ergotol min. xv q. 4 hours for 48 hours.
(c) General diet 1st morning postoperative.
(d) Vaginal irrigation (hycol) daily after 1st day postoperative.
(e) Out of bed on 3rd day postoperative if not bleeding.
(f) Discharged on 5th day postoperative unless contraindicated.

8. *Information to be Given Staff Patients on Leaving Hospital.*

No patient is to leave the hospital without seeing the Resident or House Surgeon for instructions.
Explain carefully about amount of exercise to be taken.
Explain in detail diet to be followed. Make out anticonstipation regime (filling in definite hours on blank). Refer to family doctor or clinic. If clinic, give a clinic card on which diagnosis is written.
Explain about follow-up clinic so that patients will understand why they are wanted back.
Ask patient to report any change of address.

9. *Section of Ophthalmology.*

Intern seeing emergency case or any case necessitating immediate treatment *must* take visual acuity of the patient before touching the eye or instilling drops or ointment. Charts for this purpose are on the second and third floors.
In all cases necessitating treatment by

the Intern, where infection is present, smears should be taken before any instillations.

Where dressings become loosened on postoperative cases, Intern will reinforce them without removing the dressing, carefully avoiding pressure over the postoperative eye.

10. *Section in Urology* (Standing Orders).

a. Acute retention of urine.

(a) To be classed as an emergency demanding hospitalization and immediate attention by the Urological Staff. If Urological Staff is not available then House Staff will have to catheterize.

(b) Catheterization not to be done until decompression apparatus is set up so that when the catheter is passed it can immediately be attached to the apparatus. The decompressor and tubes should be full at the time of connecting with catheter. The trap of the decompressor should be placed at that level to which urine rises at the time of connecting the catheter. If decompression apparatus is not available then a tube should be attached to the catheter before any urine is allowed to flow and by means of gravity urine should be allowed to flow only a few drops at a time. The height of the tube should be lowered each day, so that it should take in all about four days to empty the bladder. A soft rubber 16 French catheter should be used, but if patient cannot be catheterized with this, a 16 French natural curve silk catheter should be used. If for any reason patient cannot be catheterized or cannot bear urethral catheterization, a suprapubic cystotomy under novocaine should be done and the bladder decompressed this way.

(c) Blood chemistry for urea nitrogen should be ordered.

(d) Patient should drink a glass of water every half hour, varying this with orangeade, grapolade, or lemonade. Glucose may be given with this. Diet-milk.

(e) If there has been vomiting and water cannot be retained, clysis may be instituted.

(f) Order s. s. e. daily.

b. Preoperative Preparation for Prostectomy.

(a) Blood urea should be normal.

(b) Phenolsulphonephthalein output should be as nearly staple as is possible to get it, with little variation from day to day.

(c) The bladder should be kept clean with daily washes of mercurochrome solution 1:500.

(d) Patient's heart should be examined and if there is any suggestion of decompensation operation should not take place until the heart is as normal as possible. Patient should be digitalized.

(e) Patient should be able to be up and walking before the operation is contemplated, the ability to walk with the increase in heart rate and dyspnea being the best test of a good heart function.

(f) The patient should have fluids and glucose up to three hours before operation.

(g) s. s. enema should be given morning of operation.

CARE OF FRACTURES IN THE O.P.D. OF THE FIFTH AVENUE HOSPITAL

1. Every case suspected of having a fracture should be examined and cared for under the principles laid down in the "Preamble to the outline of treatment of fractures" which must be read by every member of the staff handling fractures.

2. A fracture having been diagnosed or suspected, adequate treatment should be applied for wounds and the part properly splinted following suggestions afforded in the outline for "Splinting Fractures."

3. The case is to be reported immediately to the House Surgeon or Resident on duty, who will see the case, make such examination as is necessary to confirm or amplify the diagnosis. He will give such advice regarding splinting as will permit the fracture to be roentgenographed as expeditiously as possible and make arrangements for such roentgen-ray examination.

4. The House Surgeon or Resident on duty will see that the fracture case, with roentgen-ray diagnosis, shall be reported to the Attending Surgeon, who will direct the disposal of the case as soon as possible.

5. Special care is to be taken in the following:

   a. Padding splints; use plenty of padding.

   b. Bandage snugly enough to give support and prevent movement, but avoid tight bandages.

   c. Elevate limbs to prevent swelling.

   d. Do not remove splints on new cases coming to hospital until they have been roentgenographed, unless there is some imperative reason to do so.

   e. Where Collins' hitch is used with windlass traction, protect limb with folded towels.

6. All dislocations should be treated as fractures.

SPLINTAGE OF FRACTURES IN O.P.D.

1. *Skull and nasal bones:* Admit to hospital.

2. *Vertebrae:* Admit to hospital.

3. *Clavicle:* Velpeau, sling and swathe, or crucial splint.

4. *Scapula:* Velpeau, sling and swathe.

5. *Humerus,* upper third: Axillary pad, Velpeau, sling and swathe.

   Humerus, middle and lower third: Coaptation splints plus right-angle internal or external lateral. Advise admittance to hospital.

   Elbow. Splint of wood, or anterior or posterior moulded plaster from axilla to metacarpophlangeal joints, in comfortable position.

6. *Forearm,* one or both bones: Internal right-angle splint of wood, from 6 inches above elbow to metacarpophalangeal joints, or anterior and posterior moulded plaster; position, right angle at elbow.

7. *Wrist;* comminuted radius or ulna: Splint to prevent rotation of forearm by wood or single plaster (above elbow).

8. *Hand* and fingers: Flat wooden splint.

9. *Multiple fractures of arm and forearm:* Thomas splint, elbow and hand extended, enough traction to prevent movement and shock. Support limb in Thomas splint with wide strips of muslin or flannel.

10. *Pelvis:* Abdominal complications to be considered and manipulations avoided which might aggravate lesion.

    a. Intraperitoneal hematoma.

    b. Laceration of bladder. House surgeon or Resident to catheterize if advisable.

    c. Laceration of urethra.

    d. Subparietal rupture of viscera. Prevent movement of parts by snugly fitting Scultetus binder about pelvis.

11. *Lower limb:*

    Hip: long side Hamilton splint from axilla to and including foot.

    Femur: Thomas splint with Collins' hitch on ankle. Spanish windlass for traction. Foot piece to prevent rotation with strips to support limb. Piece to elevate distal end of Thomas splint from stretcher.

    Knee: Thomas splint bent to support knee in flexion. No traction, with exception of patella.

    Leg, one or both bones: Fifth Avenue Hospital pasteboard carton splint, reinforced laterally if necessary with wooden splints.

    Ankle and foot: Same as leg or pillow splint.

INSTRUCTIONS TO PATIENTS ON DISCHARGE

For All Patients Discharged to Family Doctor's Care

1. Because you are ready to leave the hospital, does not mean that you are ready to be discharged from all medical care. Your operation has been successfully performed but that is only part of your cure. You still require attention to get the best results from your surgical treatment.

2. When you leave the hospital, go to see your family doctor, or have him come to see you. We are writing a letter to your doctor telling him everything that has been done in your case, with recommendations for further treatment. He will care for you until you are entirely well. If you have no family doctor, be sure to look up one in your neighborhood without delay. Let us know whom you select and we will notify him of your treatment while under our care.

3. You will be supplied with directions as to diet and general care of yourself when you leave the hospital. *Remember that these directions do not take the place of the attention of your doctor.* They merely help him to carry out your further treatment.

4. We will send for you by postal card to come back to see us later for an examination. *Be sure to come when we ask.* We will examine you carefully and make sure that everything is progressing favorably, and will write to your doctor about anything we may find, or any suggestions that we have to make.

5. In the event of any trouble, do not take a chance on treating yourself or following the advice of friends. See your doctor, and if necessary he will get in touch with us.

6. Have your dentist fix all your teeth up. We will tell you what you should have done to them to keep well.

For All Patients on Discharge

1. Because you are ready to leave the hospital, does not mean that you are ready to be discharged from all medical care. Your operation has been successfully performed but that is only part of your cure. You still require attention to get the best results from your surgical treatment.

2. Follow your diet carefully.

3. Get at least eight hours' sleep every night.

4. Have your bedroom windows open every night. Cover yourself as warmly as you care to *but keep the windows open.*

5. Get some open air exercise every day, even if it is only a half hour's walk. If you exercise by walking outdoors, walk briskly, swinging the arms and breathing deeply.

6. Be sure that your bowels move regularly. If they do not, consult your doctor instead of taking patent medicines from the drug stores.

7. Be sure to return for examination when you receive the postal from us.

Instructions to Toxic Goitre Patients on Leaving the Hospital

1. The following instructions should be carefully followed in order to receive the maximum benefit from the operation. Because you are ready to leave the hospital does not mean that no further medical care is required. You will derive the best results from the operation if for the next several months the following advice is adhered to.

2. Eat plain food, milk, eggs, cereals and water are to be taken freely. Avoid red meats, highly seasoned foods and condiments. Do not take tea, coffee, alcohol. Do not use tobacco. Avoid overeating.

3. For the next three months restrict social activities. Avoid excitement. Reduce household or business cares to a minimum. After three months gradually resume your normal business and social life.

4. Spend much time, during your early convalescence, in the open air. Walk and exercise in moderation. Avoid fatigue. Retire about 9 P.M. and try to sleep or remain quiet in bed until 9 A.M. Lie down for one or two hours every afternoon. Then gradually resume your regular habits or rest and exercise.

5. Be sure to keep the bowels regular.

6. Report back to follow-up clinic when sent for, for examination.

Empyema and Lung Cases

1. Because you are ready to leave the hospital, does not mean that you are ready to be discharged from all medical care. Your operation has been successfully performed but that is only part of your cure. You still require attention to get the best results from your surgical treatment.

2. Exercise as you did in the hospital, to expand your lungs.

3. Keep out in the open air as much as possible. Get an outdoor job if you possibly can.

4. Follow your diet carefully.

5. Keep your bowels well open.

6. Stop smoking for at least three months. Your doctor will tell you when it is safe to smoke thereafter.

Gastric Cases

1. Because you are ready to leave the hospital, does not mean that you are ready to be discharged from all medical care. Your operation has been successfully performed but that is only part of your cure. You still require attention to get the best results from your surgical treatment.

2. Follow your diet carefully.

3. Do not overeat at any time.

4. Do not take alcohol in any form for at least three months.

5. Do not smoke or chew tobacco for at least three months.

6. Keep bowels open.

7. Be sure to follow advice as to teeth and nose and throat.

8. Do not do work requiring heavy lifting for at least eight weeks.

Diet for Stomach Cases First Two Weeks after Leaving Hospital

Diet B

BREAKFAST

Fruit: ½ orange or grapefruit. Prunes.

Cereal: All kinds, with small amount of sugar and plenty of cream.

Egg: Soft-boiled, poached, omelet.

Toast or bread and butter.

Cocoa.

DINNER

Cream soups

Small amount of one of the following:

  White meat of chicken

  Fish

  Roast beef

  Roast lamb

  Lamp chops

  Scraped beef

Baked or mashed potatoes with butter.

Salads of all kinds.

All green vegetables.

Custards, ice-cream, creamed tapioca, etc.

SUPPER

Milk toast.

Creamed oysters.

Any of above dinner dishes.

NOTE: Use very little seasoning in food. Eat small amount, and often. Plenty of eggs, milk and cocoa between meals.

Postoperative Diet for Gall Bladder, Stomach and Intestinal Cases

Diet A

GENERAL DIRECTIONS: Take moderate quantities of plain nutritious foods. Avoid excesses of meat, all rich foods, and eat only moderate quantities of starches and sugars.

MAY TAKE:

Soups. Meat soups in small quantities, mutton (weak), chicken (weak), beef (weak), oyster, bouillon, rice, tapioca, barley, vermicelli, clamp vegetable.

Lean Meats. Roast mutton chops, lamb chops, broiled, broiled and roasted chicken, broiled or roasted squab, ham, bacon, broiled or roasted birds (once a day).

Fish. Raw, broiled, or stewed oysters, broiled or boiled rock, bass trout or bluefish.

Eggs. In small quantity, coddled or soft boiled.

Vegetables. Spinach, young peas, string beans, potatoes, (baked, small quantity), turnips, cauliflower, cabbage, lettuce (without vinegar), celery, cresses (without vinegar), onions.

Farinaceous Foods. Rice in small quantities, oatmeal, cornstarch, sago, tapioca, arrowroot, hominy, grits, vermicelli, cream of wheat, stale wheat bread, toast, graham bread, rye bread, corn bread, pulled bread, swieback.

Desserts. Blanc-mange (no sugar), custards (no sugar), rice pudding (no sugar), tapioca pudding (no sugar), bread pudding (no sugar), milk pudding.

Fruits. Lemons, oranges, apples (tart) raw, baked or stewed, stewed apricots, raw or stewed peaches, stewed prunes, stewed cherries. Fruit to be stewed without sugar.

Fatty Foods. Butter.

Drinks. Taken mainly with meals. Milk, buttermilk, peptonized milk, milk with vichy, milk flavored tea or coffee, kefir, kumiss, junket whey, lime juice or lemonade, (without sugar), water, hot water, mineral water, vichy, apollinaris poland, lithia, carlsbad.

MUST NOT TAKE:

Rich soups, fried foods, hard boiled eggs, pork, veal, stews, hashes, turkey, corned meats, potted meats, liver, kidney, duck, goose, sausage, crabs, lobsters, preserved fish,

smoked fish, salted fish, salmon, salt mackerel, sardines, radishes, mushrooms, asparagus, tomatoes, dried beans, old peas, pickle, sweet potatoes, beets, hot breads or cakes, nuts, candies, preserves, pies, pastry, rich puddings, cheese, strong tea or coffee, alcoholic stimulants, sweet wines, ice cream, stewed berries, cider.

Appendectomies

1. Because you are ready to leave the hospital, does not mean that you are ready to be discharged from all medical care. Your operation has been successfully performed but that is only part of your cure. You still require attention to get the best results from your surgical treatment.

2. Follow your diet carefully.

3. Keep your bowels well open by your diet and by taking one tablespoonful of mineral oil every morning and night. If you still have trouble, tell your doctor, don't resort to patent medicines.

4. *Do not overeat.* Eat less at one time, and more frequently.

Anal Cases

1. Because you are ready to leave the hospital, does not mean that you are ready to be discharged from all medical care. Your operation has been successfully performed but that is only part of your cure. You still require attention to get the best results from your surgical treatment.

2. Take hot sitz baths, such as you had in the hospital, twice daily for one week. Your doctor will advise you as to continuing them for a longer time.

3. Sponge anus with warm water after each bowel movement.

4. Keep bowels well open. If they do not move readily and easily see your doctor instead of trying patent medicines.

5. Avoid violent cathartics, such as salts, etc.

6. Take a tablespoonful of mineral oil three times daily.

7. Have your bowels move, if possible, at same time each day.

8. Follow your diet list.

9. Do not take enemas unless your doctor advises you to.

Gall Bladder Cases

1. Because you are ready to leave the hospital, does not mean that you are ready to be discharged from all medical care. Your operation has been successfully performed but that is only part of your cure. You still require attention to get the best results from your surgical treatment.

2. Follow your diet carefully.

3. Never eat heavy meals. It is better to eat smaller meals more often.

4. Keep your bowels well open. If you have difficulty in so doing, don't take patent medicines, but see your doctor.

Hernia Cases

1. Because you are ready to leave the hospital, does not mean that you are ready to be discharged from all medical care. Your operation has been successfully performed but that is only part of your cure. You still require attention to get the best results from your surgical treatment.

2. For two weeks after leaving hospital do no lifting or straining.

3. For four weeks after leaving hospital do no *heavy* lifting. Light lifting allowed.

4. After four weeks from time of discharge from hospital any work can be done.

5. Wear suspensory bandage or supporter for eight weeks after leaving hospital.

6. Follow general instructions.

Patients upon Whom Perineal Repairs Only Have Been Done

1. Same as in other instructions.

2. If you have a discharge from the vagina, it is nothing to worry about. As long as it is annoying take a douche of 2 quarts of hot water in which a tablespoon of soda bicarbonate (baking soda) has been added. Do not have the douche bag more than 2 feet above your hips. Take at least 20 minutes to run through the 2 quarts. Take the douche lying down. If discharge continues more than 1 month consult your doctor.

3. You will probably have pains near your rectum for some months after operation. Be sure you keep your bowels open in order that you may not develop hemorrhoids.

4. Refrain from intercourse for 1 month.

Directions for Fracture Cases Leaving the Hospital

You are not well yet. Your stay in the hospital was for the purpose of doing all the surgeons could and deemed proper to correct the injury to the bone. We have tried to obtain the best position of the pieces of the broken bone, so that you can get the best use in the

quickest time. We want you to know that this does not mean that the bones are in perfect position. This rarely happens; but we feel that you will recover so that you will be able to use the injured part again. You will have to be cared for and directed what to do until the bone has grown solid again or "knit," and the muscles have become strong. While this is taking place at home, you are to keep your foot or hand above the level of your heart to keep the swelling away, as frequently as possible.

Come to the Clinic the day after you leave the hospital at nine o'clock in the morning, or see your doctor. Your doctor can find out from the hospital what was wrong with you, and what was done for your injury. Pay attention to what the doctor tells you, and do as he says. If you go to your own doctor he is responsible for your care.

1. You will have to be told when the dressings are to be removed.
2. How you are to move your joints.
3. What to do when you have pain.
4. When to use the limb and how much.
5. What you must do to get your muscles strong again.
6. When you can go back to work.

If you cannot see your own doctor you can wait and come to the Surgical Clinic 9 to 10 every morning, except Sunday.

If there is anything wrong, come back to the hospital any time day or night and the doctor will tell you what to do.

Improvement in fracture goes on for a period up to several years.

ADVISABILITY OF ROENTGENOGRAPHING SINUS TRACTS FOR DIAGNOSIS*

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FREQUENTLY the surgeon observes sinuses which apparently can be accounted for by the history obtained from the patient, by the physical examination and by the flat roentgenograms. Nevertheless, often very valuable data may be obtained by the injection of these tracts with lipiodol or some similar substance and another roentgenogram taken. In the author's experience in 2 recent cases the operation would have been a failure had not the additional data been obtained from the injection of the tracts to be roentgenographed. The case histories and roentgen-ray photographs are given in these cases, as they seem to illustrate the necessity for this further study:

In Case 1 there was a history of what was presumably an osteomyelitis. The patient had a discharging sinus below the posterior gluteal fold. The roentgenogram showed evident osteomyelitis of the ischium. Had we not injected the sinus and taken the roentgenogram, the operative procedure on the ischium would have resulted in complete failure.

In Case 11 the diagnosis was made by the roentgenogram. We were prepared, from our knowledge of the distribution of the sinus tract, for an extensive operative procedure, and therefore the operation was successful. We would not have recognized the condition had we not had a roentgen-ray picture of the injected tract.

Two cases of osteomyelitis with sinuses are reported wherein the injection of the sinuses confirmed the diagnoses and definitely outlined the operative procedure:

CASE 1. Miss A. D., a woman aged nineteen, was admitted to the Fifth Avenue Hospital on February 13, 1929. Three years ago she began to have right hip pain and was unable to walk. She was treated then and kept in bed for one and one-half months. Six

months later she had a discharge on the inner side of the right leg. The sinus was curetted, drained and packed for the last two years.

FIG. 1. Case 1. Flat roentgenogram showing bone changes in ischium (A) suggesting osteomyelitis.

It has cleared up three times for comparatively short intervals. The patient complains of pain only when the lesion heals and fails to drain. Her main complaint is that she is unable to flex her thigh in climbing stairs.

Physical examination showed a well-nourished and well-developed white female in no acute distress, and was essentially negative save that there is a sinus tract leading from the medial aspect of the right buttock up into the gluteal region; otherwise not remarkable. Movement of the lower limb was limited on abduction and flexion, but motion was not impaired or abnormal otherwise.

Roentgen-ray Findings. Stereoscopic films of the right hip and pelvis after the injection of lipiodol into the sinus on the posterior surface of the thigh show that the sinus tract runs upward to the bony process in the ischium and then around the posterior portion of the hip where it divides into two sinuses. It then travels toward the median line in one sinus tract until it enters the rectum. A film made several hours later shows the lipiodol in the rectum. (Figs. 1 and 2.)

Operation. The injection of lipiodol into the sinus tract had shown that the tract ran upwards to the ischium where there was an area of osteomyelitis, and then back of the hip joint around into the posterior portion

of the pelvis about the level of the fourth sacral vertebra and entering the rectum at this region. It had been impossible to see the entrance of

FIG. 2. Case 1. Injected sinus tract (A) showing tract extending through bone tunnel in ischium (C) and then posterior to head of femur and into rectum (B).

the tract into the rectum by proctoscopic examination; therefore it seemed advisable to close the fistula by the abdominal route. Patient was placed in a high Trendelenburg position and a left paramedian incision from the pubis to above the umbilicus was made. The intestines were brought well out of the pelvis. The uterus was grasped with the tenaculum and held upward. At the beginning of the anesthesia two ureteral catheters had been inserted by cystoscopy into the ureters in order to make their differentiation easy. On palpation the right ureter could be easily felt and identified. The posterior peritoneum was split a little below the promontory of the sacrum and dissected downward to the utero-sacral ligament, and the rectum dissected downward. It was found necessary also to separate the peritoneum at the cul de sac on the posterior surface of the cervix. An assistant with a finger in the rectum from below warned the operator of any approach near the rectal mucous membrane. It was found on dissection downward that the rectum was densely adherent on the right side of the pelvis

from the sacrococcygeal junction upward. By blunt dissection proceeding from the muscle, in order not to cause a rent in the

swollen and tense at the time of her illness, when she was running a high fever. Her sinus in the thigh did not open until six months after
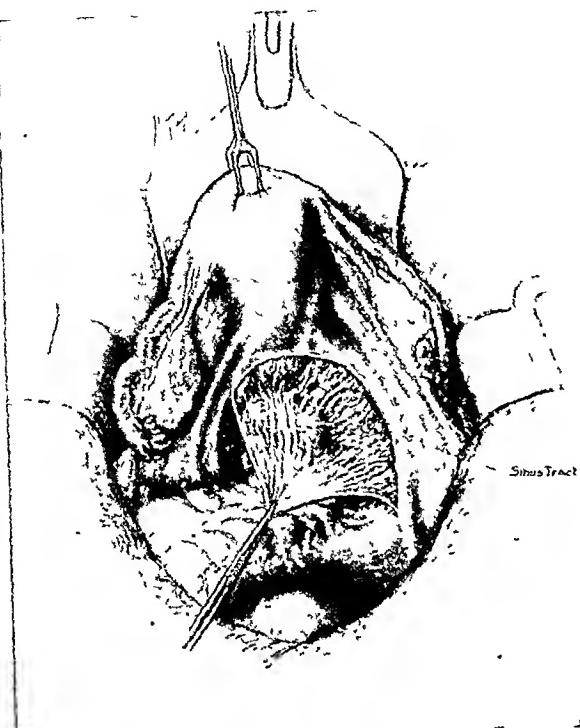
FIG. 3. Case 1. Artist's sketch at operation showing reflection of peritoneum and sinus tract.

FIG. 4. Case 1. Diagrammatic drawing showing location of sinus entrance into rectum.

rectum where it would be difficult to repair, the rectum was gradually separated from the pelvis. The procedure was long and arduous, on account of the density of adhesions. Finally the sinus tract was located and cut across. A probe was inserted through the lumen into the rectum at this junction and at distal portion of the tract a sound could also penetrate, thereby identifying the tract. The sinus opening into the rectum was closed with interrupted sutures of Pagenstecher and reinforced with fine chromic gut. It was impossible to do anything to the distal portion of the tract as it was right at the pelvic junction. A cigarette drain was inserted down to the pelvic area and the posterior peritoneum closed as an apron around the uterus so that the entire area of the rectum was walled off from the general peritoneal cavity. The abdominal wound was then closed in layers in the routine manner, the cigarette drain coming out of the lower angle of the incision. (Figs. 3 and 4.)

Comment. This patient, it is assumed from her history, had an attack of acute osteomyelisit of the ischium. She says that her leg was

she was out of bed. Her first flat roentgenogram revealed the osteomyelitis. With the injection of the sinus it was discovered that the tract ran to the area of osteomyelitis in the ischium and then upward and posterior and entered into the rectum anterior to the sacrum. It is assumed therefore that while she was in bed pus burrowed down the deep planes of the thigh and perforated into her rectum. Later, when she was up and about, the secondary abscess broke on the posterior surface of the thigh, forming her present fistula. Methylene blue injected into the sinus was recovered by a rectal enema. We could not, however, see the orifice by proctoscopic examination. It is obvious that any operation on the ischium would result in failure because the sinus tract would constantly be reinfected from the rectum. Considerable thought was placed upon how to approach and close the rectal sinus. It could have been done either by going up in the lateral pararectal fossa or by splitting the vagina or by a posterior Kraske approach. It seemed wisest, however, to approach through the abdomen, split the peritoneum and dissect downward along the lateral wall of the rectum. This was done, but the procedure was very

difficult as the section had to be carried downward to within about 2 inches of the anus.

Postoperative Course. The patient did well

occasional twinge when he extended the great toe. He visited a doctor who said there was some fluid present which would probably

FIG. 5. Case 11 Roentgenogram of foot before and after injecting tract. A, Sinus orifice; B, junction of sinus and extensor longus pollicis tendon sheath; C, tendon sheath.

for about ten days and then developed temperature and pain in the right lower quadrant with a palpable mass. She was handling the infection well and it was thought best to temporize and see which way the infection would point. It was felt that if it were opened by the abdominal approach, if the hole in the rectal wall had not been completely closed a fecal fistula might result and if drained either by rectum or lateral to the rectum the same difficulty might occur. Fortunately the patient had a sudden discharge of pus through the vagina and her temperature and symptoms immediately subsided. The sinus on the thigh closed three days after the operation and has now remained closed for somewhat over two months. There is no induration or tenderness. She is able to flex her thigh without pain and I believe will remain well.

CASE 11. Mr. D. S., an Armenian twenty-two years of age, was admitted to the Fifth Avenue Hospital on March 3, 1929, with a history of a draining sore on the foot. Two months before the patient had noted a small white swelling on the dorsum of the right foot. This was painless except that there was an

disappear. The condition remained the same for about one month, giving him no pain on walking or other symptoms. About four weeks ago he began to have redness and swelling of an area on the dorsum of the foot. He visited a doctor, who opened it and got out some dark red material but very little pus. It was treated with elevation and hot soaks. He had pain when he lowered the foot but not otherwise. The wound healed and then the foot suddenly became swollen and very painful but this was relieved when the patient squeezed the area and evacuated a large quantity of pus. Since that time he has had a draining sinus from which he could express pus by pressing over the dorsum of the great toe and points proximal over its extensor tendon.

Physical examination was essentially negative save that over the dorsum of the right foot over the tarsometatarsal junction there is a draining sinus, with an area of inflammation the size of a dime surrounding. The swelling extends distally along the extensor longus hallucis tendon and pus exudes from the sinus on pressure over this. There is pain on pressure over the base of the great toe.

Roentgen-ray Report. Films of the right

foot in the anteroposterior and lateral directions show no roentgen-ray evidence of bone or periosteal infection. Stereoscopic films were

Fig. 6. Case ii. Later roentgenogram of tract.

made of the right foot after the injection of lipiodol into the sinus on the doral surface of the foot. The lipiodol runs upward for a distance of about 1.5 inches from the opening of the sinus and down the dorsal surface of the foot over the metatarsal bone of the great toe to the region of the base of the proximal phalanx of the great toe. The course of the lipiodol is along the tendon sheath. At no point does it communicate with any bone and the entire solution is in the soft parts. I am unable to detect any evidence of bone or periosteal involvement. (Figs. 5 and 6.)

Operation. An incision was first made over the distal portion of the tendon at the metatarsophalangeal joint. The appearance of the tendon and the character of the granulations suggested a tuberculous process. The incision was therefore lengthened as far upward as the ankle joint, and the complete synovial sheath, which appeared diseased throughout with sluggish-appearing granulations, was dissected free from the tendon and excised. The sinus tract from the skin entrance to the tendon

sheath was also excised. The wound was thoroughly washed with ether and the fascia was sutured over the tendon with interrupted
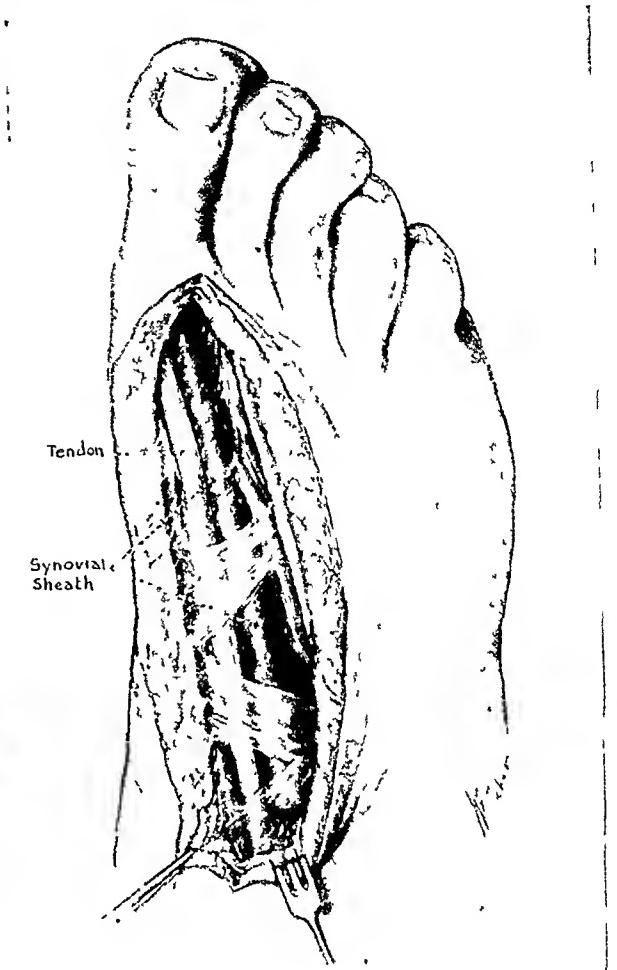
Fig. 7. Case ii. Artist's sketch at operation.

No. oo chromic gut sutures. The skin was united loosely with interrupted Stewart fine dermol sutures. The foot was put up at right angles with a posterior plaster-of-Paris molded splint. (Figs. 6 and 7.)

The pathological report of the tissue removed shows a tuberculous tenosynovitis. There are numerous giant cells, tubercles, and areas of chronic inflammation.

Comment. The plain roentgenogram showed no bone involvement. The injection of the sinus showed that the tract ran mesial for about an inch from the entrance of the sinus and then its distribution coincided with that of the tendon sheath. After the original incision elsewhere the patient undoubtedly had a secondary infection. An excision of the

entire sheath was followed by rather slow but complete healing of the wound.

CASE III. Mr. R. D. was admitted to the

FIG. 8. Case II. Artist's sketch showing method of synovial sheath excision.

Fifth Avenue Hospital on April 8, 1928, giving a history of pains in the right leg and foot of four months' duration. Ten years ago he was struck with shrapnel in the right leg. For the next year and a half he was confined to bed in various hospitals in England, France and Scotland, where nine or ten operations were performed on his leg. The patient says that the operations were done to remove pieces of shrapnel, scrape the bone and remove diseased bone.

For a considerable period of time this patient had non-union and had several operative procedures to remove pieces of bone. Finally union occurred, although there was a certain amount of deformity. For the last six months he has been suffering from a discharging sinus in the middle of his leg and another area which occasionally breaks down on the anterior surface of his tibia immediately below the tibial tubercle. Occasionally he gets cramps in that leg. The patient walks, using the outer side of the right foot. When the foot is everted

pain is felt along the medial arch and behind the medial malleolus.

Physical examination was essentially negative

FIG. 9. Case III. Flat plate showing chronic osteomyelitis near head of tibia and sequestrum (A).

except that on the anteromedial surface of the tibia of the right leg are two wounds, one in middle of leg, which is superficial, discolored and covered with a thick bloody crust about ½ inch long. This wound is not discharging nor is it tender. In the upper third of the shaft of the tibia, 1 inch medial to the tibial tubercle, is another wound 2 inches long, diamond-shaped and 1 inch deep. The wound is not discharging and is tender only at its inferior angle. The skin covering the wound is red, shiny and smooth. In the center of the wound there is a small crust of blood and serum. On the lateral aspect of the leg are two scars. Also over the inner condyle of the tibia there is another scar. The right leg as a whole is

deformed. There is a bowing posteriorly. The head of the fibula is displaced posteriorly and its outline down the leg is lost for a considerable

rather definite bowing but no areas of bone destruction and no definite periosteal change. No evidence of sequestrations or active bone

FIG. 10. Case III. Injection of sinus tract (B) with injection travelling to sequestrum (A).

FIG. 11. Case IV. Flat plate showing repair in old osteomyelitis of femur with cortical ' sequestra (A and B).

distance. The leg is 1⅛ inches shorter than the left leg. Sensory nerve endings are disturbed in the right leg. There is a diminution in pain sense throughout the entire leg. On the plantar surface of the right foot tactile sense is increased. Sensations of heat and cold are not disturbed. Movement of the leg is not interfered with. There is a diminution of muscle tone and muscle strength.

Roentgen-ray Report (April 9). Films of the right leg in the anteroposterior and lateral directions show the tibia altered in shape, density and structure from a former infection and surgical operations. The fibula shows

infection in the tissue can be detected. In the posterior portion of the leg 6 inches below the knee joint and directly behind the middle of the tibia there is a small irregular calcified area. This is either a calcification resulting from operative procedure or it is a small bit of detached bone. It is not evident from the roentgen-ray appearance whether or not it is associated with the sinus. (Fig. 7.)

Roentgen-ray report (April 11): Stereoscopic films of the right leg after the injection of lipiodol into the sinus show the sinus tract outlined distinctly. The calcified area seen in the plain films lies in the sinus tract and the lipiodol is seen surrounding it. We believe this is a small bit of detached bone. (Fig. 8.)

Operation. An elliptical incision was made along the mesial border of the tibia. The

muscles and scar tissue were bluntly dissected free from the posterior surface of the tibia and the cavity in which the sequestra lay was
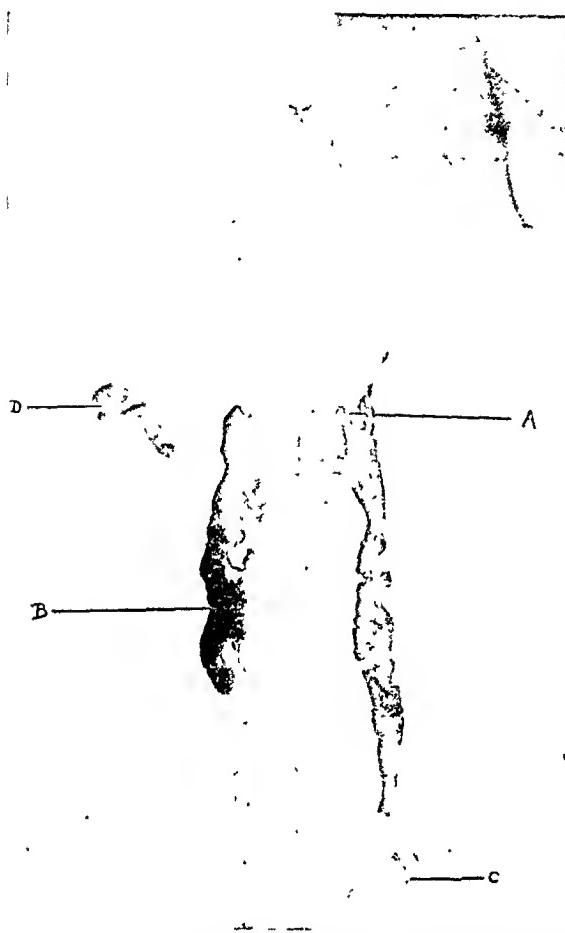
FIG. 12. Case IV. Injection of sinus (c) with lipiodol. A and B, cortical sequestra; D, previous sinus to skin, now closed.

opened. This was grasped by a Kocher clamp and removed. It was thought unnecessary to attempt to dissect out the tract as with the removal of the foreign body it would probably close. The wound was left wide open and Dakinized in order to assure that there would be no secondary infection. The scar was removed from the upper area where the skin was attached to the old cavity in the tibia and with a fine curette this area was gently explored. There was no evidence of any infection; the bone was cancellous in type. There was no evidence of any sinus tract or sequestrum. A plain gauze dressing was inserted over this area. The remainder of the other wound was treated with vaseline gauze and Carrel tubes.

Comment: (See Case IV.)

CASE IV. Miss V. S. was admitted to the

Fifth Avenue Hospital July 21, 1927. She gave a history of a draining sinus in her right thigh for the past six months. A painful swelling in the left thigh about nine years ago was opened and drained for three months. She had a high fever at this time and also a similar swelling in the left arm, which was drained. Her present trouble began about eight months ago with a painless small swelling on the right thigh, which opened with serous discharge and has been draining continuously since. There is no pain, no fever, no interference with motion. Drainage is the only symptom present.

Roentgen-ray Report (July 18). Stereoscopic films of the right hip and upper half of the femur show a definite bone process involving the upper third or half of the femur from just below the lesser trochanter downward. There is an area of bone destruction apparently encircling the cortical portion of the shaft about $1\frac{1}{2}$ inches in length. There is marked cortical thickening above and below this area. There are some calcifications in the soft parts along the involved areas which are either periosteal hypertrophy or calcifications in the soft tissue from the chronic infection. We believe these changes are infectious in origin and of the type of a low-grade osteomyelitis, and the source of the sinus in the thigh. (Fig. 9.)

Roentgen-ray Report (July 22). The sinus in the thigh was injected with lipiodol and stereoscopic films were made in the antero-posterior and lateral directions. The sinus tract is shown distinctly. It runs upward and inward and backward to the involved area in the femur, then behind the femur and down the outer border for a distance of about 3 inches. There is a blind tract running outward from the area of bone destruction. This is located somewhat posteriorly and does not reach the surface. Along the inner margin of the destructive area in the shaft of the femur there is a narrow area of increased density which probably represents a sequestrum. (Fig. 10.)

Operation. A semielliptical incision with convexity toward the ventral surface was made, and a fascia lata incision in the same line. There was a dense scar-tissue membrane surrounding the femur. When this was penetrated a sinus tract was encountered lined with a sluggish granulation tissue. The tract went posterior to the femur in the area shown in the roentgen ray. A small sequestrum was removed on the anterolateral surface of the femur; another larger one was removed from the

anteromedial surface. Both these sequestra were identified as showing in the roentgen-ray. The tract was well opened up. The pocket extending laterally in the vestus externus was continued to the skin so that tubes could be inserted through this tract and allow a gravity drainage. Three rubber rubes were inserted through this counterdrainage incision. The original wound was closed loosely with silk-worm sutures, gut sutures through the skin, fat and fascia lata.

Comment on Cases III and IV: These 2 cases had discharging sinuses with a history of previous osteomyelitis. In each there were one or two sequestrae in the soft parts. After injection of the sinuses with lipiodol it was proved that the reason the sinuses continued to discharge was due to the sequestrae located in the soft parts. The removal of the sequestrae without any further procedures on the shafts of the long bones was followed by prompt closure of the sinuses and recovery of the patients.

CONCLUSIONS

1. Four cases are reported wherein the injection of the sinus tracts with lipiodol and roentgenograms taken established a diagnosis.

2. In Case I an unnecessarily mutilating procedure would have been performed with subsequent failure had not the diagnosis been made of the continuation of the tract entering into the rectum.

3. In Case II the diagnosis was made, from the roentgen-ray, of tuberculous tenosynovitis and the operative procedure planned.

In Cases III and IV simplified operative procedures were performed with resultant cure. Had not the tracts been roentgenographed more mutilating operations on the shaft of the femur and tibia might have been performed.

I wish to express my gratitude to Dr. Lewis Gregory Cole and Doctor Robert E. Pound for the excellent roentgenograms and diagnoses which were made in these cases.

NASAL ACCESSORY SINUS DISEASE & MASTOIDITIS IN INFANTS AND YOUNG CHILDREN*

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IN this article we propose to discuss briefly the embryology of the face, to call to your attention certain anatomical facts in relation to the accessory sinuses of the nose and the ear in children and the remote effect of these structures as foci of infection, and purposely avoid a discussion of the part played by the tonsils and the other structures of Waldeyer's ring.

EMBRYOLOGY

The upper part of the face, that is, that part which lies above the mandible, is formed by the growing down of the frontonasal process which ultimately develops the nasal septum, the outer nose, the central portion of the upper lip, that portion of the upper jaw which lodges the incisor teeth, and probably also the ethmoid labyrinth. The lateral part of the face including the eyes, the maxilla, including the antrum, the inferior turbinate and the hard palate develop from the lateral or maxillary processes. As these structures infold to unite with each other, they carry with them the developing blood vessels and their capillaries, and the

various lymphatics or lymph spaces. From the mechanism of this method of development of the face we can, by "back track-

FIG. 1. Lateral view of left nasal passage in infant six months old, showing relationship of three turbinals, floor of nose and Eustachian tube. Broom straw will be seen emerging from nasal duct.

ing" so to speak, determine the manner in which lymph drainage takes place from these elements to the more central chains of lymph glands.

POSTNATAL ANATOMY

Onodi in 1911 produced his very exhaustive work on the accessory sinuses in children and demonstrated the presence of all the sinuses at birth. He called the frontal recess or infundibulum, the frontal sinus and used these terms interchangeably. Our own conception is that the infundibulum should not be called the frontal sinus until it has actually invaded the frontal bone. With this conception of the situation we may say that the frontal sinus is the only one not present at birth.

In 1920 Schaefer published his work on "The Nose and Olfactory Organ." In this work he demonstrates the early development of the accessory sinuses, and speaks of a well-developed maxillary sinus as early as the 120th day of fetal life. The ethmoidal cells develop as early if not earlier, and when seen at birth, are the best developed of the accessory sinuses.

The frontal sinus, the anterior ethmoidal cells and the maxillary sinus drain into the middle meatus of the nose. The posterior ethmoidal cells and the sphenoidal sinuses drain into the upper part of the naso-

FIG. 2. Lateral view of left nostril of infant four days old, showing three turbinals, low position of inferior turbinate, and broom straw in Eustachian tube.

pharynx. Drainage from the middle meatus is downward and backward to the nasopharynx and region of the pharyngeal

orifice of the Eustachian tubes. It will be obvious therefore to the thoughtful, that posture plays an important rôle in the

LYMPHATICS

The periosteum of bone is richly supplied with lymphatics; they have been described

FIG. 13. Outer wall of left nasal chamber in infant one year fifteen days old, showing same general appearance as preceding pictures. Note obvious drainage from nasal chambers into region of Eustachian tubes.

drainage of these sinuses and also in the drainage from these sinuses to adjacent parts. Mothers should be instructed there-

in the Haversian canals. They are absent in cartilage and probably in bone marrow. Lymphatics of the nose drain into the

FIG. 4. Outer wall of left nasal passage of infant nine months of age. Middle and superior turbinates removed, infundibulum uncovered showing its extent at this age; posteriorly, sphenoidal sinus may be seen quite well-developed.

fore to change the posture of the sleeping infant frequently, so that drainage may be favored from the Eustachian tube orifices. Lying on the belly should be encouraged.

parotid lymphatics the retropharyngeal glands, the superior deep cervical glands and then into the jugular trunk, in close relation to the jugular vein.

The lymphatic vessels of the muco-periosteal lining and walls of the nasal fossae terminate in the postpharyngeal

lary, parotid and superior deep cervical lymphatics may result from disease of the nasal fossae.

FIG. 5. Outer wall of left nasal chamber of infant six months of age. All three turbinates removed. Broom straw may be seen in nasal duct. Infundibulum may be seen reaching forward to floor of frontal bone, and posteriorly, a well-developed sphenoidal sinus is again seen.

lymphatic glands and the superior deep cervical lymphatic glands. Through the cribriform plate of the ethmoid bone

The lymphatics of the middle ear terminate in the posterior auricular and parotid lymphatic glands. The lymphatics

FIG. 6. Outer wall of right nasal chamber of infant six months of age, showing characteristic drainage to tubal region.

these vessels communicate with the intracranial lymphatics and the subdural space, affording a channel through which meningitis may be produced by caries of the upper portion of the wall of the nose. Involvement of the postpharyngeal, internal maxil-

of the internal ear terminate in the tympanic and intracranial lymph vessels.

With a definite communication between the lymphatics of the nasal chambers and the cranium and internal and middle ear it is not difficult to explain the develop-

ment of both the nerve and obstructive types of deafness, which are manifested later in the life of the individual.

The Eustachian tube is the direct means of communication between the naso-pharynx and the middle ear. It is a col-

FIG. 7 Transverse section through right nasal chamber and orbit of infant six months of age, showing nasal septum, hard palate, nasal chamber, three turbinates, and maxillary sinus.

ANATOMICAL RELATIONS

To understand accessory-sinus disease one must recognize the fact that no "locked

lapsed tube in its cartilaginous portion. The pharyngeal orifice in the infant is on a level with, or slightly below the level of

FIG. 8. Horizontal section through left nasal chamber of infant nine months of age, at level with upper border of inferior turbinate. Anteriorly, nasal duct may be seen, then maxillary sinus; posteriorly, floor of a well-developed sphenoidal sinus.

door" separates the cavity of the sinus from the cavity of the nose, and that in an infection of the nasal passage, one cannot assume immunity for the sinus; both are involved always to a greater or less extent.

the hard palate, thus favoring direct drainage into the tube itself. The tube in the infant is shorter than in the adult and opens into the upper part of the tympanic cavity. The tympanic cavity opens pos-

teriorly by way of the aditus directly into the mastoid antrum. At birth there is no mastoid process, there is only the mastoid

FIG. 9. Horizontal section through orbit and right nasal chamber of infant twenty-two days old, showing broom straw in nasal duct, inferior turbinate, maxillary sinus, and floor of orbit.

antrum and again there is no door to prevent involvement of the antrum; when one is infected the other of necessity is likewise infected.

From this review of the anatomy of these parts one is forced to recognize:

1. The likelihood of accessory-sinus infections not only being complications of, but being a component part of every nasal infection.

2. The likelihood also of otologic involvement being not only associated with, but also being a component part of nasal infection.

3. The possibility and the probability of systemic involvement with these structures acting as primary foci.

Most of the misconception regarding accessory-sinus disease is a direct result of the fact that the subject was approached first by having our attention drawn to the extreme types of this disease, namely the "locked-in-empyema" with its pain, pus and positive roentgen-ray findings. This type of case we may say today is the rare

type and the type most frequently existing is the type most frequently unrecognized, that is the type in which the sinus becomes

FIG. 10. Horizontal section through right orbit and right nasal chamber of infant nine months old. On level with middle of ethmoid labyrinth, at left, will be seen roof of these cells. On right may be seen broom straw in nasal duct together with well-developed cells, and posteriorly, sphenoidal sinus.

infected as a direct complication of the general nasal infection and which by reason of its anatomical characteristics is afforded drainage and therefore produces no pain, is negative to roentgen-ray findings and produces only symptoms referable to a focus of infection.

We find in recent literature reports of the same pathologico-anatomical situation in the so-called antritis cases, in otological practice. Here the infant's antrum becomes an overflow reservoir for the infected middle ear, and immediately there obtains an antritis which if not evacuated becomes a focus of infection.

All pathological processes produce certain permanent tissue changes, microscopic at first, involving only certain

isolated cells, but as the same sort of attacks are repeated more and more damage is done until the changes become

Hajek found a chronic recurring erysipelas of the face cured only after discovering a chronic suppurating antrum.

FIG. 11. Horizontal section through ethmoid region of right side of infant four days old. Broom straw shown in infundibulum and another in nasal duct. On left, towards roof of nose, olefactory slit and four well-developed ethmoidal cells, may be seen.

macroscopical. Repair is accomplished by the formation of scar tissue only and as scar tissue contracts, blood vessels become constricted and terminal atrophy supervenes. Obviously then the time to institute prophylactic treatment against catarrh of various types in the adult is in childhood.

EXTRACTS FROM LITERATURE ON ACCESSORY SINUS AND OTOLOGIC INVOLVEMENT

According to E. Frankel the accessory sinuses are diseased in 75 per cent of all cases of influenza. Prym and Bruck arrived at similar conclusions. These men were considering only the adult and mostly in epidemic infections. It shows, however, the frequency of involvement of the sinuses in bacterial invasions. Wertheim found that nearly every third tubercular body had an inflammatory affection of the accessory sinuses. This did not depend on the tubercular infection but on ordinary so-called congestion.

Lindenthals found that in influenza, the influenza bacillus appeared constantly in the sinuses. In diphtheria a pure diphtheria membrane has been definitely found by Weichselbaum.

Wolf found that in diphtheria of the upper air passages, the accessory sinuses nearly always participated.

E. Frankel viewed the diplococcus pneumonia as the chief cause of accessory sinusitis. He also says that in twenty-eight normal accessory sinuses he found the Frankel-Weichselbaum diplococcus of pneumonia most frequently, so

FIG. 12. Temporal bone at birth. Tympanic ring will be seen on surface and absence of an external osseous canal and mastoid process will be noted. (In normal position tympanic ring faces almost directly downward.)

it seemed that in pathologic conditions it was only a question of an increase in the number of bacteria existing in the sinuses under normal conditions that produced the disease.

Recent literature is replete with discussions of accessory-sinus disease in childhood, and of otological complications of nasal infections,

and as far back as 1684 DuVerney spoke on pus in the mastoid antrum of young infants; but considered this to have originated post mortem. In 1921 Maurice Renaud found pus in the mastoid antrums of 70 infants dying of gastrointestinal disturbances.

symptom complex of increasing temperature, diarrhea, vomiting, loss of weight and athrepsia.

FIG. 13. Temporal bone in infant six months old, showing a beginning external osseous canal and mastoid operation done to demonstrate size of mastoid process at this age.

Byfield and Floyd, working in conjunction with Dean of Iowa City, noted the frequent occurrence of mastoid infection in infants suffering from the symptoms mentioned.

Bernard Mahon states in a series of 39 cases of mastoiditis in infants occurring at St. Louis Children's Hospital from September 1926 to May 1927, that 56.4 per cent showed the

Clement F. Theisen in an article on "Ethmoiditis in Infants and Young Children," quotes Coakley as saying: "With chronic nasal discharge existing in young children with the absence of adenoids, the presence of sinus

FIG. 14. Temporal bone of child one year of age, showing still further development of external osseous canal and mastoid process. Operation has likewise been done on this case.

disease is fairly positive." The majority of cases of sinusitis in children under four years of age are ethmoidal involvement. He describes a case of acute ethmoiditis with orbital abscess and exophthalmos in a child six months of age.

J. J. Shea of Memphis, Tenn., in an article on the "*End-results of Sinus Surgery in Children*," concludes:

but should enter actively into the discussion of the need of myringotomy or mastoidectomy.

5. Paranasal-sinus disease may cause all
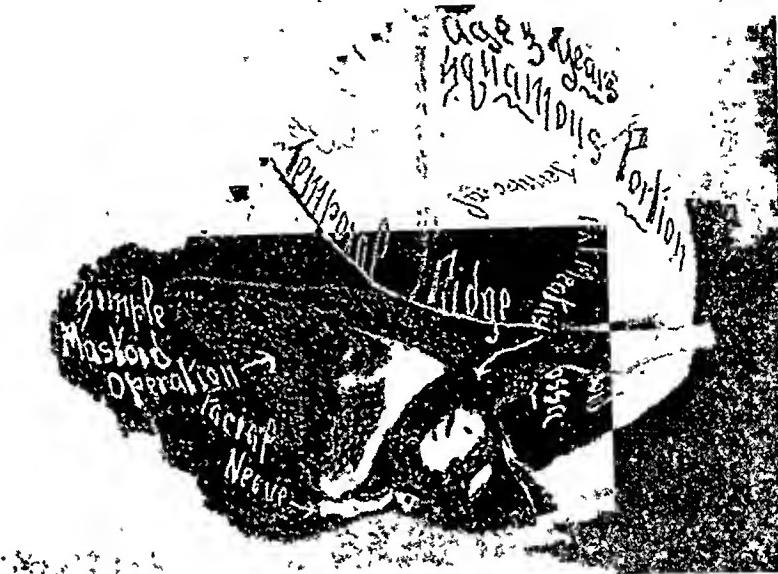
FIG. 15. Temporal bone of child three years of age, showing development of external osseous canal and mastoid process in growing child. Mastoid operation was done in this case to demonstrate size of mastoid process at this age.

1. The end-results of sinus surgery in children has been satisfactory, the initial improvement being gratifying.

2. The majority of the sinus cases originate in the practice of the pediatrician and should be referred to a rhinologist for treatment.

3. The reabsorption of the discharge by the sinuses is dangerous and productive of constitutional diseases. The intention of the surgeon should be the production of continuous drainage and ventilation of the sinuses.

L. W. Dean of Iowa City, in an article on "*Acute Otitis in Infants*," concludes:

1. The symptoms which lead to the discovery of otitis in infants are much more frequently pediatric than otologic.

2. The conditions which decide the choice of treatment in otitis are more often pediatric than otologic, refusal of food, dehydration, diarrhea and loss of weight may be the factors that will decide whether myringotomy should be performed. They may indicate mastoidectomy.

3. The otologist and the pediatrician should work in the closest cooperation and have complete confidence in each other.

4. The pediatrician should not confine his work to the general treatment of the child,

the conditions enumerated in this article, except perhaps, syncopal death. In the presence of these conditions, a positive diagnosis of otitis should not be made unless an objective sign of the otitis exists.

6. If otitis is present, it can always be diagnosed.

7. Paranasal-sinus disease not unusually coexists with acute otitis. It is as a rule advisable to treat the patient for both. It is often difficult to decide which is the most influential in causing the systemic disturbance.

Mark L. Floyd of Iowa City, in an article on "Alimentary Intoxication," summarizes:

1. Certain infants, usually between the ages of eight weeks and eighteen months may suddenly develop symptoms suggesting a primary gastrointestinal disturbance resembling the alimentary intoxication described by Finklestein.

2. The symptoms are all marked, being lethargy, frequent and loose stools and dehydration, with great and rapid losses in weight in spite of symptomatic and supportive treatment. The bowel condition does not respond to diet rearrangement.

3. At necropsy, the only positive finding was pus in the mastoid.

4. Mastoiditis is masked, the symptoms being those of a severe gastrointestinal or nutritional disorder.

nerves and blood vessels passing through them, thus becoming continuous with dura mater at the superior orbital fissure.
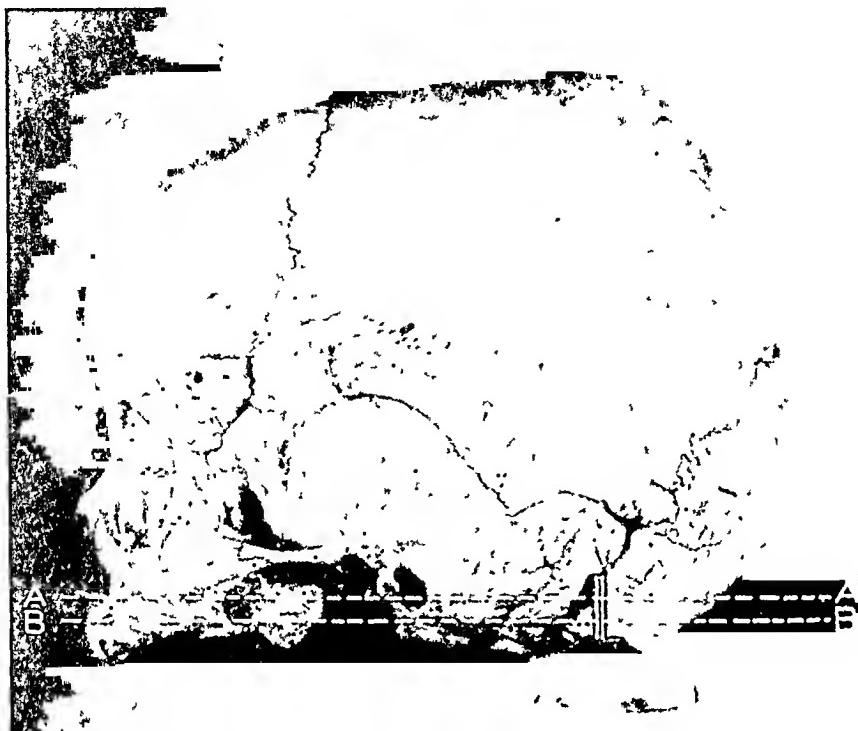
FIG. 16. Side view of skull of infant four months old on which line A-A1 has been drawn to show relationship of hard palate, and line B-B1 to represent floor of tympanic cavity. (This, taken in conjunction with shortness of Eustachian tube and low position of tubal orifice in infants will explain prevalence of otitis media in childhood.)

5. Bilateral mastoidectomy performed as soon as the condition is determined and other foci eliminated, has resulted in prompt recovery of many of these infants and is probably the only means of saving the child's life.

Denneth A. Phelps of Minneapolis, in an article on "*Cellulitis of the Orbit in Infants*," says: "the most frequent and usual cause of orbital cellulitis is often overlooked, and by experienced physicians. There are several important anatomic conditions of the sinuses and the orbit in children which favor and contribute to the development of orbital complications of sinusitis."

1. Regarding the bones, there may be congenital dehiscences along the ethmomaxillary suture, in the lamina papyracea, or in the orbital wall of the maxilla. The orbital bones are softer in children, ossification not being complete, and the sutures are ununited until the sixth year.

2. The orbital periosteum is thin and delicate: It not only lines the openings into the orbit, but forms one of the coverings of the

3. The sinus mucosa is in most intimate relation with the caseous tissue, so a slight inflammation of one produces a change in the other.

4. There is more profuse development of the lymphatic and vascular system than in the adult. Infection from the sinuses may enter the orbit along the veins without any bony perforation. Thus the infection in a child's nasal sinus has a much easier path to the orbit than it has in the adult. We are all aware of the frequency of subperiosteal abscesses of the mastoid in children and should realize that the same condition could occur in the orbit as a result of infection in the nasal sinuses.

Roy A. Barlow of Madison, Wis., in an article on "*Recognition of Sinus Disease in Children*," states: "The work of Dean and Byfield has stimulated investigation for the relief of sinusitis in children and has resulted in untold benefits for the children suffering from 'chronic colds' due to infection of the paranasal sinuses. Past histories have convinced me that many children have had

sinusitis and the correct diagnosis has been passed by, because of failure to recognize the condition.

Our attitude in regard to sinusitis in children is easily explained when we recall that it has never been impressed upon us that children possessed sinuses before they had reached the age of puberty. Even the most recent tests on sinusitis devote only five or six lines to the possibility of sinuses in children and add that the reported cases were really osteomyelitis and bone necrosis.

The antrum may be present in infants as young as six months and at twelve months or a little more it is quite well developed, as are also the ethmoids.

The maxillary sinus appears in the third month of fetal life as a small out-pouching from the lateral wall of the ethmoid infundibulum. The ethmoids arise from grooves and recesses in the lateral walls of the middle and superior nasal meati. The frontal sinus arises from an extension of the anterior and superior middle nasal meati.

Symptoms: The acute attacks are accompanied by the usual fever, general malaise, and so forth; usually within three or four days the sinus ruptures intranasally, the pain and general symptoms are relieved and only profuse nasal discharge remains.

Many cases of sinus disease in children are neglected or overlooked. All were overlooked years ago and it is not unreasonable to suggest that a neglected sinus infection in a child may be the etiologic factor in many cases of hay fever, nasal asthma and polyp formation in later life, to say nothing of its possibility as a focus of infection."

SUMMARY

Much more could be quoted, but space prevents. We may therefore conclude:

1. That there exists at birth all of the accessory sinuses more or less well developed, with the ethmoid group well developed and the mastoid structure in the form of a mastoid antrum. All of these structures communicate directly with adjacent cavities.

2. That when the principal cavities, namely the nasal passage and the middle ear, are infected, the accessory sinuses and the mastoid antrum are likewise infected.

3. That any one of these cavities may become a focus or infection, the symptoms of which are remote from the situation of the focus.

4. That the symptoms which are a result of the existence of these foci may be relieved only by the recognition of, and the removal of the focus.

5. As these foci frequently produce no symptoms referable to the focus they can only be excluded by a careful comprehensive examination of these parts.

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PRELIMINARY REPORT OF AN OPERATIVE PROCEDURE FOR GLAUCOMAS*

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BECAUSE of the limited number (12) of cases in which this procedure has been used in its entirety and the limited length of time over which the results have been observed, it is necessary to call this a preliminary report and withhold any claims until a later date.

There is probably no ocular disease in which there is a greater diversity of opinion as to the correct choice of operation than glaucoma and many operators who use a certain operation for one type of glaucoma use an entirely different procedure for another type. Men who elect to do a comparatively simple iridectomy in one case, turn to the Elliot trephine, the Lagrange sclerectomy or cyclodialysis in cases where they would not expect the iridectomy to be sufficient. The purpose of the procedure presented in this paper is to secure a method which is applicable to practically all glaucomas, the degree to which it is carried to be determined by the purpose which the operator desires to accomplish. To arrive at the decision as to what end is to be attained, I take the liberty of making two simple classifications of glaucoma, namely, the type in which we may hope to reestablish normal drainage and the type in which, due to the permanent interruption of the normal drainage system, we must create an artificial drainage by means of a cystoid scar. It is understood and acknowledged that in some complicated glaucomas, such as hemor-

rhagic glaucoma, a posterior sclerotomy is safer and advisable.

The first part of the operation is the

Fig. 1. Schematic representation of traction. A. Present technique. B. New technique. (1) Direction in application of forceps. (2) Direction of traction in delivery of iris.

iridectomy with the dissection of the "iritic" root after the manner described by Török[1] and I report this verbatim with the permission of the author. The second part of the operation consists of a sclerectomy by means of a slightly modified Vacher-Stephenson scleral punch.

Iridectomy is still the classical operation for glaucoma and is the one which is performed in preference to other procedures in all cases where its performance promises success.

There are many theories advanced to explain the mode of action of iridectomy. Most of these are only of historical interest and therefore not enumerated in this paper. The one which is generally accepted is based upon the theory that the maintenance of normal intraocular pressure is accomplished by the aqueous being drained off through the spaces of Fontana by the Schlemm canal, thus having a continuous flow. Pathological examinations of glaucomatous eyes show that the spaces of Fontana in glaucoma are obstructed so that the aqueous cannot be drained. This obstruction may be due to the root of the iris being pressed against the posterior surface of the cornea without being adherent to it, or the root of the iris may be solidly glued to the posterior surface of the cornea by organized plastic exudate. This organized plastic exudate may also entirely fill and obliterate Schlemm's canal.

Now pathological examinations of glaucomatous eyes, where iridectomy was successfully performed, but which were enucleated

[1] Török. Arch. Ophthalmol., 52: No. 6, 1923.

for some other reason, have shown that the reduction of tension was obtained either by the opening of the passage at the iritic angle
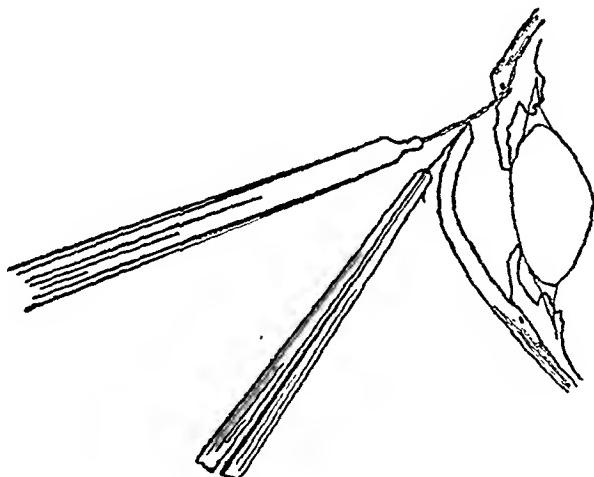
Fig. 2. Detaching adherent root of iris.

for the exit of the fluid or by the formation of a new channel by means of a cystoid scar. Therefore a successful operation for glaucoma must either reestablish the natural channel of drainage or form a new permanent channel. This according to Elschnig can be obtained by either detaching the root of the iris from the periphery of the cornea or incising it, thereby producing a direct communication between aqueous and Schlemm's canal. The opening between anterior chamber and Schlemm's canal must be large so that a sufficient quantity of aqueous may be drained off through it to maintain normal intraocular pressure. The reestablishing of this communication can be obtained by a large peripheric iridectomy, by means of which the root of the iris is detached from the cornea and then excised so that it cannot reattach itself again.

This is the universally accepted theory nowadays as to the mode of action of iridectomy in glaucoma. It is self-evident therefore that iridectomy in glaucoma will not be successful if the root of the iris is not detached by reason of faulty technique. These are the cases where a second properly performed iridectomy reduces the tension permanently. It also will be unsuccessful when the root of the iris cannot be detached owing to too firm adhesions. These are the cases where although the iridectomy was performed correctly according to our present technique, the iris tears off anteriorly to the adhesion so that its root remains behind and the iris angle stays

obstructed. Finally irideetomy will be a failure even though the root of the iris is detached and exeised when Schlemm's eanal is obstrueted by
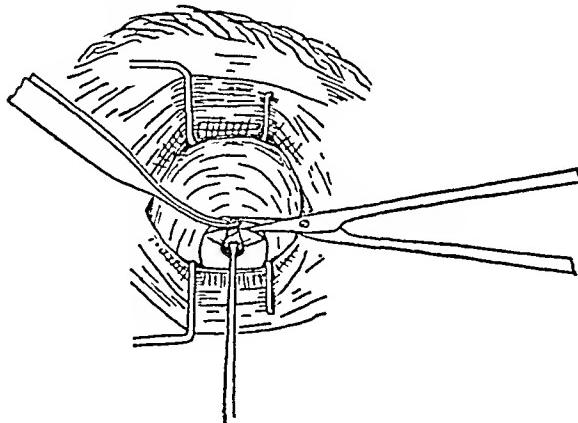
FIG. 3. Excision of iris, showing application of foreeps, delivery of iris and position of scissors.

organized plastie exudate thereby losing its pateney.

These latter eases are usually met with in patients suffering from ehronie inflammatory glaueoma of long duration espeeially if they have had one or more aeute attacks. Irideetomy is not in order in these eases, but one of the operations whieh establishes a new ehannel of drainage sueh as the Lagrange operation or the trephining.

Now, there is no doubt in my mind that irideetomy is a safer operation than either Lagrange's or Elliot's and therefore preferable to either one. Suffiee to mention iridoeyclitis and late infections, and I believe that with the exception of the last group mentioned above where Schlemm's canal is not patent, iridee-tomy, if we sueceed in detaehing the root of the iris and excising it, will produce a perma-nent drainage of the intraoeular fluid . . .

An iridectomy on a glaueomatous eye will be performed as follows:

· The eyeball is fixed in the limbus at either end of the horizontal meridian of the cornea with a double fixation forceps such as Schweig-ger's or one similar to it. This will greatly facilitate the section as it will eliminate the rotation of the eyeball, a complication which is most disturbing. The incision is made above, puncture and counter puncture being in the selera, and the section terminating behind the limbus with a conjunctival flap. It is similar to the one made in Lagrange's operation but not

carried quite as obliquely through the selera, the cutting edge of the knife having been turned forward when the eorneoseleral junetion
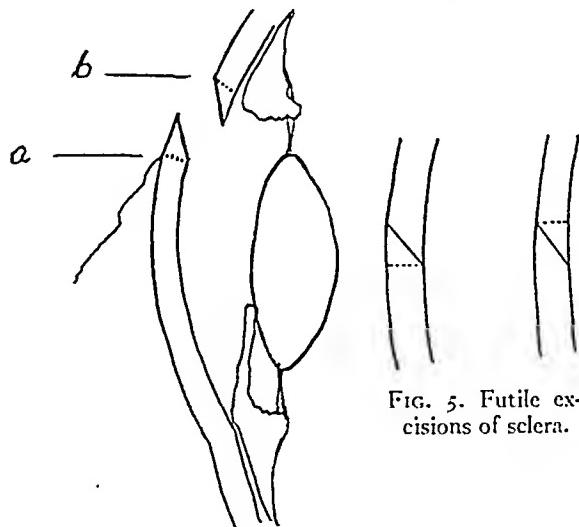
FIG. 5. Futile ex-cisions of selera.

FIG. 4. Excisions of selera.

(2 mm. behind the limbus) is reached. The eonjunetival flap is now grasped with an ana-tomieal foreeps and gently pulled forward making the wound gape thereby. With an iris spatula, holding it always in elose eontaet with the selera, the root of the iris is detaehed throughout the whole extent of the wound and if one wishes the spatula ean easily be pushed still further forward between eiliary body and selera as far as the supraehoroidal space. The eiliary body is thereby detaehed and a eyelodialysis from the anterior ehamber performed. If one always keeps the spatula in close eontaet with the selera, there is no danger of injuring the eiliary body or losing vitreous.

The assistant now takes the anatomical foreeps and keeps the wound gaping by means of traetion on the conjunetival flap and the surgeon grasps the iris with the iris foreeps. This is done by introdueing the foreeps parallel with the wound, one blade being plaeed near the root of the iris, the other one a few milli-meters below. The foreeps is now elosed and the iris drawn out, gentle traction being exerted forward and slightly downward toward the patient's feet and exeised with two sweeps of the scissors. The scissors are held parallel with the wound and placed upon its posterior lip by holding them slightly tilted so that one blade is actually in the anterior ehamber. The pillars of the coloboma are now replaced

if necessary, the conjunctival flap smoothed out and a bandage applied.

If the operator's object is the restoration of the normal drainage system, the operation is now complete. If however, our objective is the formation of a cystoid scar, we proceed from this point as follows:

The conjunctival flap is separated from the sclera by blunt dissection with scissors and if the failure to make the incision far enough back into scleral tissue causes the scleral shelf of the lower edge of the wound to be too short, a slight separation between the layers of the cornea is made by a continuation of the same use of the scissors.

Maintaining traction upon the conjunctival flap with thumb forceps to prevent possible button-holing of the flap, the solid blade of the 3 mm. scleral punch is introduced below the lower shelf and, closing the hollow blade upon it from above, a button is excised represented by the dotted line (a) in Figure 4. The punch is now reversed with the solid blade again within the eye and applied to an opposing position on the upper shelf, which is already cleared of iris structure below and conjunctival structure above, the blades closed and an adjoining button of sclera excised from the upper shelf represented by the dotted line (b) in Figure 4. The removal of these two buttons precludes the possibility of merely removing one thin edge and thus failing to create a patent drainage opening between the two lips of the wound as would be the case in Figure 5.

Assuring ourselves that the iritic pillars are free from the incision, the conjunctival flap is replaced. It may be secured with a stitch though to me it seems unnecessary and because of the increased possibility of infection, unwise. The usual after-toilet is made and the eye dressed and bandaged.

Daily dressings are done after the first forty-eight hours and the patient allowed to leave the hospital on the eighth day.

CHRONIC APPENDICITIS—WHAT IS IT?*

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THERE are two reasons why most medical discussions are not worth the time spent on them. The first is that the discussers seldom adhere to the topic. The second, and more important, is that there is such poor definition of most medical terms that no two people are talking about the same thing.

If a group of physicians is gathered together, there is no topic that can be brought up that is more certain to produce a heated argument than "chronic appendicitis." Opinions of the curability of this condition vary from 100 per cent on the part of certain enthusiasts to a 30 per cent estimate from sceptics. The reason for this discrepancy in figures is that the two groups are probably talking about different things.

The term "chronic appendicitis" means one thing to the clinician, another to the surgeon, a third to the roentgenologist and still a fourth to the pathologist. Hence, it is quite obvious that these four can never be brought to any unanimity of opinion until a common ground for discussion is arrived at.

I propose that the term "chronic appendicitis" as a final diagnosis should be junked as inadequate. The same applies to chronic cholecystitis and salpingitis, as the nomenclature of these conditions is in the same befuddled state.

The word "chronic" is derived from the Greek and means relating to time. The suffix "itis" means inflammation of. Now, the final opinion as to the degree of any inflammatory process is, at the present time, in the hands of the microscopist, and when an organ, such as the appendix, is sectioned and stutied under the microscope, I cannot see why the pathologist has a basis for any statement as to the length of time that the inflammatory process has been going on. If we use the term "chronic" to apply solely to the length of time that the symptoms have been present, we are using it in its correct sense, but when we try to use it to modify the degree of inflammatory reaction, it doesn't make any sense. Hence we will never get anywhere until we divorce the two words in the final diagnosis, if we are to base that final diagnosis solely on microscopy.

This confusion of terms has led to the ridiculous situation in which the pathologist returns a diagnosis of "chronic appendicitis" when he does not see any evidence of what he understands as "chronic appendicitis," in order that the records may not disagree. But he does this in a condescending mood, the while believing that surgeons are a group of avaricious dolts who remove an appendix for no very tangible reason unless it be the money collected therefrom. This situation is hardly scientific, and leads to the grouping under one head of a series of cases which are widely divergent in their characteristics.

It is my firm belief that it is perfectly possible for an appendix to produce symptoms which justify its removal and yet not show any evidence recognizable by the majority of pathologists of being involved in any pathological processes. I base this statement on my belief that we have not yet learned to identify the morphology of very early inflammatory disease. Just as we have a great deal to learn about cytology, so have we a great deal to learn about the microscopy of early inflammatory disease. If any one has any doubt about the progress which can be made in cytology, all he has to do is to look at the living leucocyte by the supravital staining method and then see the same cell after it has been dried, fixed, and stained for the usual differential blood count. That "living tissue study" would reveal similar differences cannot be doubted.

Under the existing terminology, if a surgeon chooses to remove an appendix, he must apply to it one of three diagnoses:

1. Acute appendicitis.
2. Subacute appendicitis.
3. Chronic appendicitis.

I have no quarrel with the first of these three terms, but I claim that the other two, in the last analysis, mean nothing.

We are at present engaged in a study of intra-abdominal inflammatory disease. After reviewing some sixty cases of appendicitis operated upon by different surgeons, I was at once struck with the impossibility of drawing any deductions from them because none of the descriptions of the gross pathology was based on the use of common terms. What one operator calls one thing, another calls a second and a third a third. Most of the operators used the term "chronically inflamed" to describe any pathological state other than the acute.

If we are to make progress in the study of this vital problem, we must have uniformity in describing the condition of things immediately before the operation, during it, and the results of the laboratory studies which ensue therefrom. To this end, we are offering a guide for surgeons to follow in describing (1) their reasons for performing the operation; (2) what they find after the abdomen is opened; and (3) the correlation of the first two and the laboratory data.

There are only five reasons for a surgeon to remove an appendix:

1. He believes the appendix is undergoing an inflammatory reaction which, if uninterrupted, will probably result in general peritonitis and death. To this

condition we have applied the term, "symptoms active and progressing."

2. He believes that the appendix is involved in an inflammatory process, but does not believe that the symptoms are growing progressively more severe.

3. After a review of the history, he believes that the patient has had one or more attacks of acute appendicitis, but the organ is not in such a condition that if he were to let it alone, it would immediately go on to abscess formation, perforation, etc. The patient probably has some type of gastrointestinal fault, which for want of a better term we call indigestion. Deep pressure in the right lower quadrant elicits some rigidity in the right rectus and some pain. To this condition we have applied the term "symptoms dormant."

4. Because the surgeon has the abdomen open for some other purpose and because the appendix is readily available, for prophylactic reasons he believes it best to remove it. This reason we have termed "prophylaxis."

5. A gastrointestinal series has revealed the fact that the appendix does not empty readily or there is some deformity of the cecum which may or may not be accompanied by signs of irritability of the pylorus. This patient was suffering from our old friend "chronic" indigestion. From a study of many cases we have learned that, if the appendix is removed and if it was causing the gastrointestinal delay, the patient will be cured. As a reason for removing such an appendix we give "radiological evidence."

It seems to me that our greatest fault lies in the fact that we are much too prone to jump to conclusions instead of being satisfied with an accurate description of exactly what we can see and feel. When the abdomen has been opened and conditions in and around the appendix can be inspected and palpated, the surgeon is in a position to make certain definite statements. This, I believe, is as far as he should go. He should not try to sum up the entire situation by some such statement as "the appendix appears to be chronically inflamed." We see certain pathological conditions and rather than study them as they exist, we stick a name on them which implies deductions which we are in no position to substantiate.

One of the simplest observations which a surgeon can make is the anatomy of the appendix. The little space in the lower left-hand corner of the chart (Fig. 1) gives him the chance to draw in the anatomy provided he has had the opportunity of seeing it or feeling it before its position has been changed, due to operative procedures.

Inspection of the appendix usually permits the surgeon to state what kind of pathological process is involving it. The most usual is inflammatory process.

Now, in order to be as lucid as possible, let us discuss the more obvious degrees of inflammatory reaction first. Going on the assumption that the inflammatory process progresses from edema, swelling and redness to the formation on the serosa of a plastic exudate, thence to abscess formation and finally gangrene, in other words that gangrene is the most severe degree of inflammatory process, I have listed the degrees of inflammatory reaction in this order.

If an appendix is gangrenous, it is readily apparent that it is so. The only description that is necessary is the extent of the gangrene in relation to the organ. If an appendix is involved in an abscess, that, too, is readily apparent. Here all we need do is to state in what part of the organ the abscess occurs and how much of it is involved. If the appendix is covered by a plastic exudate, this also is readily apparent and calls only for a description of the distribution of the exudate, that is, whether it covers the entire organ or, if not, what portion of it.

Now between the time when the appendix is covered with a plastic exudate and the time of the onset of the inflammatory process comes the stage of which, I believe, we know so very little, unless evidences of

the inflammatory reaction be quite gross. This I have called "first-degree inflammatory reaction" for want of a better term.

can be made only after direct palpation of the entire organ, which would, of course, be inadvisable if the operator believed

Reasons for Removal	What Surgeon Sees and Feels	Laboratory Data		
Symptoms active and progressing	Inflammatory Pathology	Was some other organ adherent to appendix by what appeared to be fresh adhesions?	When peritoneum was first opened was there fluid readily apparent?	1 Culture of knife blade
Symptoms active	A 1st degree Inflam Color—Distribution 1 Pale 1 even throughout 2 Red 2 where		Did it resemble serum milk cream	2 Culture of peritoneal surface or fluid on opening swab pipette smear
Symptoms dormant	Consistency of walls 1 Thin, flaccid 1 even throughout 2 Thickened 2 where	What organ pelvic omentum ileum	Blood in appearance?	
Prophylaxis				
Radiological evidence	B. Plastic exudate Distribution 1 even throughout 2 where	Was tip or portion of body adherent to parietal peritoneum below or over brim of pelvis?	Did it have an odor?	3 Culture of serosa of organ swab pipette smear
Organ involved	C. Abscess 1 Involves entire organ 2 Where			
Appendix				
Gall Bladder	D Gangrene 1 Involves entire organ 2. Where			4 Other Cultures location swab pipette smear
Tube				
	Mechanical Deformity of contour—where of blood supply—where of lumen—where			5 Other Cultures location swab pipette smear
	Neoplasm Distribution Lymph nodes			6 Parasites
	Lymph Nodes of Meso-Appendix Were Palpable Distribution Number Biopsy			
Anatomy Draw it in wherever possible		Comments		

Operator

FIG. 1.

There are certain observations about it which we can make.

1. As regards the color of the organ and the distribution of that color. Is it pale? Is it red? If it is red, is that redness distributed evenly over the organ, or what portions are involved? (I do not know of a better term to apply to the color of a normal appendix than "pale." Perhaps the term "normal intestinal color" might be better.)

2. What is the consistency of the walls of the appendix? Is it thin and pliable, as we might expect a normal appendix to be (to which we have applied the term "flaccid")? Or is there a thickening of these walls? If so, does that thickening extend over the entire organ, or involve only a portion of it?

It is obvious that this latter observation

that by so doing he would be contaminating portions of the peritoneum which had hitherto been uninvolved. Under such conditions this observation can be made after the organ has been removed and the surgeon has finished his operation.

Another type of pathological process in which we find the appendix involved is to my mind best called "mechanical." In this there is some deformity of contour, such as kinks, twists or bends, or there is some deformity of blood supply, or there is some deformity of the lumen and wall as exemplified by the fact that the caliber of the organ varies markedly at different sites. There may be a hard body within the lumen which we cannot readily milk up into the lumen of the cecum, showing that a constriction has occurred proximal to what is equivalent to a foreign body even

if it be a collection to inspissated fecal material.

A normal appendix varies so in length and thickness that I do not believe that any special attempt should be made to give its dimensions. A short, almost rudimentary appendix may cause as much trouble as one which is 3 to 4 inches in length.

The appendix may be the site of a neoplasm. If this type of pathology is present a description of the distribution of the neoplasm and the presence or absence of involvement of the adjacent lymph nodes is called for.

And lastly, we have that condition in which the appendix itself does not give evidence of any pathology, but on examination, the mesoappendicial nodes will be found enlarged and hard. If so, how many of them are so involved and what is their distribution and if one can be removed from examination, what does biopsy show?

Now, having dealt with the pathology which involves only the appendix, the next observation which we can make with moderate certainty is whether some other organ is adherent to the appendix by what appears to be fresh adhesions. This other organ may be the omentum, ileum, possibly the cecum or ascending colon itself, or one of the organs in the pelvis.

Another observation of the same type which may or may not be important is whether the tip or a portion of the body is adherent to the parietal peritoneum deep in the pelvis. If this be true, it is not always possible for the surgeon to state whether these adhesions were young or old, but his impression is of vital interest.

Another observation which can be made with certainty is: when the peritoneal cavity was first opened, was there readily apparent peritoneal fluid immediately under the incision. I admit that probably all peritoneal cavities at all times contain some fluid, but what is of interest here is whether there was enough present to be readily apparent to the operator when the incision into the peritoneal cavity was made. If so, did it resemble serum in that it was clear and straw color, or was it of the consistency and appearance of milk or cream? Or did it appear to be blood or blood tinged? When the peritoneal cavity was opened, was there gas present, or did the peritoneal fluid have no odor?

Now, during the course of our operation, certain laboratory procedures should be carried out.

1. A culture should be taken of our knife blade. If a detachable type is used, the blade may be detached and dropped into a tube of bouillion.

2. As soon as the peritoneal cavity is opened and before any instruments, sponges or fingers are introduced, a culture should be taken either by swab or pipette. If demonstrable fluid is present a loopful should be taken and two smears made, one for Gram stain and the other for supravital stain.

3. As soon as the appendix has been brought into view a culture and smears should be taken from the serosa of the organ.

4. Before the appendix is removed cultures may be taken from the right lumbar gutter and probably from the cul-de-sac, as well as smears.

Another piece of laboratory data which should be available at the conclusion of the case is whether the lumen of the appendix contained parasites or not.

There is nothing to be gained by correlating the findings of different operators if these men have not agreed upon a common terminology. Statistics as to the results obtained from removing appendices for various reasons must necessarily be based upon the work of more than one surgeon. Hence the foregoing set of specifications is offered as the minimum observations which must be made in each case. I believe that if 1000 cases, each one having been detailed according to the foregoing plan, were to be reviewed and checked against an adequate follow-up examination much could be accomplished in clarifying the chaos which at present exists in regard to the desirability of operating upon

patients suffering from pathological conditions affecting the appendix.

In the long run we must correlate our gross pathological findings with the results of microscopic study of the diseased organ. The custom which exists at present to take a cross section through the tubular organ is, I believe, inadequate. It is not more logical to suppose that we can judge the pathological processes affecting the appendix by studying a cross section of it which is 1 micron in thickness than to suppose that we could judge the pathology of the entire gastrointestinal tract by studying any section of it 1 inch in length. We must learn where the normal anatomy has become distorted, what the various processes are, which are going on at the periphery and at what point the maximum pathology exists.

Lewis Gregory Cole in his recent studies of peptic ulcer and carcinoma has most clearly demonstrated the fallacy of the study of small sections and it is to the inspiration afforded by his clear thinking that the present investigation is undertaken. Sections of the gall bladder, appendix or tubes or any other organ in the abdomen undergoing inflammatory processes should be made parallel to the long axis of that organ and should include its entire length. Except by the use of celloidin sections this procedure is at present almost impossible. Methods must be developed for the cutting of large sections, thin enough to permit of their adequate microscopic study. And these sections must be cut before the organ has been grossly distorted by being immersed for comparatively long periods of time in preservative fluids.

I believe that it is only when the gross pathological data, as suggested in the foregoing outline, are compared with the microscopy of longitudinal sections and the bacteriology of the peritoneal cavity at the time of operation that we will make any progress in our study of intraperitoneal disease.

Dr. Sabin of the Rockefeller Foundation has added immensely to our knowledge of the life and functions of the white blood cells. This she has done by perfecting the technique for the study of these cells in vivo and some such similar method must be applied to the study of the cells which are in the peritoneal fluids if we are to learn the functions of these fluids.

As to the bacteriology, there are so many instances in which the clinical picture clearly indicates the presence of inflammatory processes, while any attempt to grow bacteria is futile according to our present methods of culturing, that I believe we must acknowledge that our methods are at fault and not draw the usual conclusions that bacteria are not present. Our failure to identify these organisms is only an example of our ignorance and not any indication that the bacteria are not present.

If three or four men of wide experience compare the results of their operations, classified according to the suggested scheme and not lumped under the grossly overworked and entirely inadequate term "chronic appendicitis," progress will be made in our study of intra-abdominal inflammatory disease, and not until then.

SUMMARY

To sum up, let us stop using the term "chronic appendicitis" as a final diagnosis. If we do not wish to burden the patient's memory with a long string of, to him, incomprehensible observations, let us at least be scientific enough not to use indefinable terms amongst ourselves.

An outline has been suggested which may aid materially in our study of the gross pathology of intra-abdominal inflammatory disease.

It has been suggested that sections of the appendix, or any organ, should be made in such a manner as to permit of the study of the wall of that organ in its entirety.

New methods must be developed for the identification of intraperitoneal bacteria.

THE RELATION BETWEEN TONSILLITIS & APPENDICITIS*

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H. S., female, was admitted to the Medical Service of the Fifth Avenue Hospital, January 9, 1928 for observation. On admission the patient had a sore throat, a chronic infection of both tonsils, a painful cicatrix of the plantar fascia, a negative abdomen, and some indication of an artificial menopause. An operation on her foot and a tonsillectomy were advised. The foot operation was done January 21, 1929. The following day the patient suffered nausea, which continued throughout the 22nd, 24th and 25th, at which time a basal metabolism was done, showing 25 below normal. Lack of appetite increased, pain developed in the epigastrium, tenderness developed over the right lower quadrant of the abdomen and a roentgenogram on January 31 was reported as revealing a chronic appendicitis. On February 1 the appendix was removed and the condition subsequently diagnosed by the pathological laboratory as subacute. Recovery was normal. On February 10 the tonsils were removed.

The question of possible relationship between the sore throat, the chronic tonsillitis, and the inflamed appendix seemed worthy of consideration. With this in mind a review of the literature was made of which a bibliography is attached.

A great many observations have been made from time to time and well summarized by H. B. Anderson of the University of Toronto. The following extracts are worthy of thought:

It is highly probable that tonsils are often factors in many systemic disorders where a direct bacterial connection may not be demonstrated; a relationship which has been noted since A.D. 10 when Celcus first removed tonsils. It has not been definitely settled whether the bacterial products are distributed by way of the vascular or lymph channels, or by the bowel. Quite probably each of these avenues should be considered in dissemination. The etiology of appendicitis is varied, the colon bacillus, various pathogenic microorganisms that reach the appendix, worms and their ova may cause appendicitis. An apparent relationship exists between preceding disease of the respiratory tract and a following appendicitis.

As a result of investigation, numerous bacteria, pathogenic and otherwise, have been isolated from tonsillar and peritonsillar tissue, e.g. pneumococci, various strains of staphylococci and streptococci, bacillus coli communis, etc. Based upon these bacteriological findings, the tonsils have been held responsible for the production of chronic arthritis, endocarditis, and pericarditis, chorea, acute and chronic nephritis, peritonitis, cervical adenitis chronic toxemias, neuritis, osteomyelitis, acute and chronic aural lesions and appendicitis.

The relation between acute rheumatism and appendicitis has frequently been noted, and when one recalls how often tonsillitis precedes the former, the etiological connection of tonsillitis with appendicitis is more readily apparent.

To Sir James Grant of Ottowa is due the credit of reporting, in 1893, the first modern instance of the association of appendicitis and rheumatism. The same year, Kelyonack directed attention to the occurrence of appendicitis secondary to tonsillitis. In Europe, the association of the two diseases has been more systematically studied from both the experimental and clinical standpoints, and consequently more generally recognized by the medical profession as a whole. The similarity in structure between the tonsils and the appendix has frequently been pointed out and given as an explanation of their liability to similar infection.

Adrian in 1901, succeeded in producing appendicitis in rabbits by intravenous injection of staphylococci, streptococci, pneumococci, B. typhosus, B. coli, B. anthracis and the tubercle bacillus. He regards the appendix as a point of election for the localization of general infection.

Subsequently Tedesco investigated experimentally the significance of tonsil infection using streptococcus, staphylococcus and B. anthracis. He concluded that pyogenic germs from the pharyngeal ring can, in rabbits, lead to embolic processes in the parenchyma of the appendix and that it is therefore possible for hematogenous infection to produce characteristic follicular disease of the appendix.

Mori concludes that appendicitis may originate by way of the blood channels. Kertz believes that almost every case of appendicitis is in causal connection with angina, through hematogenous infection. The conclusions of these authorities have been called in question by Ghon and Namba, as the result of their experiments, as well as by Aschoff, Ogino and others.

Schroetter thinks that an etiological connection between angina and appendicitis has been established, and that this is confirmed by the prevalence of appendicitis a few weeks after changeable seasons, when angina and throat trouble are especially common. Kelly, in reporting cases from Johns Hopkins Hospital, recognized a definite relationship.

Poynton and Paine believe they have furnished almost conclusive proof that appendicitis may result from streptococcal invasion through the blood stream, from a follicular tonsillitis.

Ogmo thinks there is no doubt that hematogenous infection does occur in some cases but less frequently than Kretz maintained. Bort and Heyde express a similar opinion. Heile does not deny the possibility of hematogenous infection, but it seems to him more natural and simple to assume that this infective agent reaches the appendix and peritoneum from the intestines.

Haeberlin thinks there is no doubt that hematogenous infection occurs after angina and scarlet fever but that the number of cases in which it plays a rôle is very limited.

Tedesco says he has produced embolism and necrosis of the appendicular follicles experimentally in rabbits. He further states that if appendicitis is immediately preceded by a tonsillitis, rapid necrosis of a follicle in the appendix with perforation or gangrene is to be anticipated; therefore operation should be performed early. Others have referred to the tendency which these cases have to develop extremely acute symptoms following tonsil infection.

Few textbooks mention any association between appendicitis and tonsillitis. Brenneman, in 1927, found it mentioned in only one out of twenty-two leading books.

Freer reports a simultaneous occurrence of tonsillitis with appendicitis in 7.5 per cent of his cases, Richter in 4.06 per cent of 172 cases.

Appendicitis may occur in greatly increased number during epidemics of grippal infection, as substantiated by Freer, Haushatter, Richter, Gioseffi, Evans, Hood, Mantle, Martin, Marrel and others.

The most interesting recent data is by Evans, of the University Clinic of Madison, Wisconsin, reported by Brenneman in 1927. He bases his report on the incidence of appendicitis, and of pyogenic infection of the upper respiratory tract, among 16,000 students at the University of Wisconsin.

During the period of six and one-third years, there were 236 cases of appendicitis, an average of 4 per school month. There were 113 cases of appendicitis in 226 epidemic days, as compared with 113 cases in about 1600 non-epidemic days, or about 8 times as many. He states that 86 per cent of the total number of cases of appendicitis showed an upper respiratory tract infection. He claims that the attack of appendicitis is apt to occur on an average of sixteen days after the throat attack. He reasons, and cites Billings and Rosenow to support his view, that metastasis from such pyogenic foci takes place when the organisms have lost a certain degree of virulence, due to the focalizing processes at the original point of entrance; but whether the infection reaches the appendix by the blood stream, lymph stream or by the intestine, is not as yet settled. All may be possible. It does however appear to reach the appendix lymph glands and finds a receptive soil in a very similar lymphoid tissue.

From the work of these men, it is obvious that the evidence concerning a pathological relationship between appendicitis and

upper respiratory tract infection varies so greatly that unexceptionable conclusions as to relative frequency and relative importance of such a relationship cannot as yet be made. That such a relationship exists frequently enough is more than probable.

It must be borne in mind that these acute infections play an important rôle in the general mechanism of lowered resistance as well as serving as a primary source of infection in appendicitis. It is probable that the localization in the appendix is not only due to the development of a selective strain of the microorganism but that the primary infection is also one of the important factors in the lowered resistance of the appendical region as an expression of general lowered resistance.

An analysis by the author was made of the 113 operations for appendicitis performed during 1928, on the Staff Service of Dr. Frederic W. Bancroft, at the Fifth Avenue Hospital, New York City. In 95 cases, definite data were recorded as to the condition of the throat on admission and as to the presence or absence of the tonsils. Twenty-eight cases had no specific data, 13 of these being designated as "acute throats," 7 as "negative" and 8 no data. Many omissions were due to the emergency of the particular case and a few to the negligence of the interne. Only those cases with complete data are considered in the following analysis.

The analysis of the 95 complete cases is as follows (the final diagnosis was in all cases taken from the laboratory report):

ANALYSIS OF 95 CASES OF APPENDICITIS

Throat Condition	Per Cent of Cases
Tonsils present	76
Tonsils removed	24
Acute throat on admission	46
Negative throat on admission	54

THE 95 CASES WERE SUBDIVIDED AS FOLLOWS

Type of Appendicitis	Per Cent
Chronic	63
Subacute	6¼
Acute	21
Acute Suppurative	5¼
Gangrenous	4½

ANALYSIS OF THE SUBDIVISIONS

	Chronic	Sub-acute	Acute	Acute Suppurative	Gangrenous
No cases	60	6	5	20	4
Tonsils present, per cent	71⅓	66⅔	100	80	100
Tonsils removed, per cent	28¼	33½	0	20	0
Acute throat on admission, per cent	41½	33⅓	20	65	100
Negative throat on admission, per cent	59	66⅔	80	35	0

An analysis of the 34 cases of acute and chronic tonsillitis and peritonsillar abscesses admitted during 1928, not including " hypertrophiedadenoids and tonsils" admitted for operation is as follows:

	Cases	Tenderness R.L.Q.
Chronic tonsillitis	10	1
Acute tonsillitis	16	4
Peritonsillar abscesses	8	0

Fourteen and one-half per cent showed tenderness in the right lower quadrant.

While no definite conclusions can be drawn from so small a number of cases it is interesting to note that in the total number of cases, 95, 76 per cent had not had the tonsils removed; 24 per cent had previously had a tonsillectomy. Forty-six per cent were admitted with an acute inflammatory condition of the tonsils and pharynx. The acute and gangrenous appendicitis cases all had tonsils present and all the gangrenous cases had an acute sore throat on admission.

The more dangerous form of appendicitis did occur in the cases in which the tonsils were present and which had a sore throat on admission. The greater the percentage of tonsillectomy the less severe the involvement, the subacute and the chronic cases not being far apart in this respect. The impression frequently held that tonsillectomy predisposes one to an appendectomy

is not apparent from this analysis but quite the reverse may be true. A continued observation of a greater number of cases would be instructive.

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A REPORT OF THE OBSTETRICAL ANESTHESIA ON THE STAFF SERVICE FOR 1928*

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OBSTETRICAL anesthesia evidently preceded all other medical or surgical procedure, if one is to believe the Holy Bible, for during that first obstetrical case it is reported that Adam was "cast into a deep sleep."

Our present obstetrical anesthesia service this past year has served 211 staff patients from December 27, 1927 to December 4, 1928. We have had fewer cases on the staff service than the average, which has been about 250 a year.

This service was rendered by 17 persons, the internes on the rotating service having from 1 to 29 cases each and averaging 19 per man. These internes come to our service having been trained and approved by the Surgical Anesthesia Staff, so we have not had novices. However, in this regard it should be noted that obstetrical anesthesia is a special branch of anesthesia and for best results a thorough cooperation of the obstetrician and anesthetist is essential. Often by special care and with equipment such as is available in this institution, birth injuries to the mother can be avoided or lessened.

In this connection, let us consider the total time spent this year on staff cases of a total time of anesthesia given the 191 cases of ninety-six hours and seventeen minutes, in surgical repair alone, we have consumed a total of thirty-two hours and forty-five minutes and we find that in giving some degree of relief for the obstetrical part of the case we have used a period of sixty-three hours and thirty-two minutes. This is a great improvement over the days of not so long ago when the delivery and repair were both done with no anesthetic. We use the Gwathmey gas-oxygen-ether machine, or open mask only.

How much more relief can we give? In 136 cases in this series in which we have a record of the time from the beginning of second-stage labor to the first anesthetic there were 268 hours and twenty minutes during which labor pains were not relieved. In the remainder of the cases relief of some type was afforded by the use of morphine, allonal, rectal anesthesia or codeine.

The statement is often heard that certain "types" or nationalities require more or less special attention to physical or mental pain than the average person. At Fifth Avenue Hospital this year, 87 patients received medications to act as adjuvants to the general anesthesia. They received 105 medications, 1 to 4 per person. These were distributed to 56 primiparas and 31 multiparas. Those requiring medication were: Jews 27, Irish 9, Porto Rican 2, British West Indian 2, Syrian 1. Our total cases by religion were: Jews 60, Protestant, Catholic, or religion not stated 172; by nationality; United States 95, Ireland 24, Turkey 16, Greece 11, Italy 10, England, Porto Rico and Russia 6, Austria and Scotland 4, British West Indies and France 3, Germany, Hungary, Roumania and Syria 2, and 1 each from Argentine, Canada, Denmark, Poland, South America, Spain and Switzerland.

Of these patients 103 were given intermittent and 51 continuous anesthesia. This consisted of ether 5, gas 25, gas-ether 27, gas-oxygen 68, gas-oxygen-ether 63; ethylene 2, chloroform 11, and none 14. Rectal anesthesia was given 4 times but was supplemented with general anesthesia in each instance. No local or spinal anesthesia was attempted. Ethylene was not used by the interne staff owing to present

regulations and the present status of this agent.

For all the anesthesias given the shortest, from beginning to delivery, was one minute; one hour and thirty-seven minutes the longest. The average of all cases was seventeen minutes. This was divided into primiparas, average thirty-four minutes, and multiparas, average twelve minutes. Patients receiving no anesthetic were 2 primiparas and 12 multiparas. The primiparas were (1) a premature breech extraction of a 5 lb. infant, and (2) a premature stillbirth. The remainder were apparently precipitate. This brings up the point that in general this service has been very prompt in getting to the delivery room, the average time that these patients have waited for the beginning of the anesthetic is nine minutes.

In attempting this study, these points were kept in mind: (1) that all statistics can be made to fit the argument. These cases except in 2 instances were not prepared by me but only the tabulation and apparent conclusions drawn from them. Here due credit should be given those who maintain the record system of the Fifth Avenue Hospital. They are not perfect, in fact in a few rare cases they are very faulty, but the average for the 217 charts submitted and here worked up was complete and satisfactory.

The plan undertaken here was to prove by the records the facts concerning (1) a belief common among many obstetricians and obstetrical practitioners that it is not safe to the infant to give morphine in any amount to the mother any time less than six hours before delivery; (2) that oxygen with some other agent is a principal factor in causing excessive bleeding; (3) that Jewish patients require more anesthesia or analgesia than other persons, and (4) that obstetrical anesthesia can be brought to a point of much greater service to the obstetrician and the patient.

1. At The Fifth Avenue Hospital, we gave 87 patients morphine sulphate with or without magnesium sulphate in doses from $\frac{1}{8}$ to $\frac{1}{4}$ grain with $MgSO_4$ varying from 25 to 50 per cent. Seventy-five received the combination and 9 single doses of morphine sulphate, 2 had allonal and 1 was given codeine $\frac{1}{2}$ grain. Twenty-one had morphine sulphate less than two hours before delivery, and 5 less than one hour. The shortest time was thirty-six minutes, the longest thirty-one hours. Not a single case of these has any record of difficulty in respiratory function or of a blue or ashy color of the infant. Of the 4 stillbirths, none of the mothers had morphine before delivery, but of the 3 infant deaths, there was one set of twins weighing 1 lb. and 3 lbs. and one apparently normal infant, all born of mothers receiving morphine sulphate. The latter patient had two hours and forty-five minutes of intermittent anesthesia and a difficult delivery which may account for this death.

2. The second theory that oxygen caused the bleeding is met with these facts: There were 18 cases of more than normal bleeding. Eight had oxygen with some other agent. Nine had morphine at some time before delivery. Every type of anesthetic except ethylene was used. This fails to support the theory.

3. That Jewish patients required more anesthesia than others was found to be true. Of 87 patients receiving 105 medications, 27 were Jewish patients who received 51. This is 31 per cent of the total patients, receiving 50 per cent of the medications.

4. In spite of the fact that 39 episiotomies were done and 2 cesarean sections, the total time lost for surgical repair was thirty-two hours, forty-five minutes. Of these surgical cases 85 were for lacerations which might have been prevented or lessened by more expert anesthesia, in either having greater relaxation, or longer anesthesia, to allow the tissues to soften instead of tearing. It is still my theory that strengthening agents such as pituitrin or quinine are possible factors in hurrying the rate and increasing the strength of the pains so that lacerations occur, but statistics on this point are missing except in 3

cases. It is apparent from the fact that 136 women were in second-stage labor a total of 268 hours and twenty minutes without that relief possible with our present apparatus and knowledge, that we can be of greater service to the mothers.

CONCLUSIONS

The Anesthesia Service of the Obstetrical Department of the Fifth Avenue Hospital is furnishing good instruction in the various types of anesthesias for obstetrical cases.

Complications of anesthesia as recorded in this series of cases have been limited to 1 patient, who had bronchopneumonia following vomiting while under anesthesia. This is an unusual record.

Morphine may be safely administered to the mother at any time prior to two hours before delivery, though 10 cases of vomiting after injection of morphine including the bronchopneumonia case indicate a possible source of maternal danger.

Oxygen is not a causative factor in the hemorrhage cases.

Jewish patients require premedication or anesthesia to a much greater extent than other persons.

Finally, the Service has done well but by careful observation and experimentation can improve the quality of the service both to the obstetrician and to the mother.

A MODIFICATION OF THE YANDEL HENDERSON RESUSCITATION APPARATUS

Apparatus and methods of resuscitation have long been the subject of our efforts, in an attempt to produce a simple and workable machine that will be foolproof. This apparatus does not reach the desired end, but is an approach to that end.

The machine consists of a high-pressure fine control valve, a graduated safety escape mercury manometer, and an inhaler. For convenience a stand is available. The method of using this machine is identical that used with the Yandel Henderson apparatus, from which this differs in eliminating the breakable and expensive flow meter, changing the type of safety valve and eliminating one valve entirely, and in the construction of the inhaler. A high-pressure tank of carbon dioxide 5 per cent and oxygen 95 per cent is attached to the yoke. By means of the control valve, to which the manometer is attached, the flow of gas is set at 8 mm. pressure so that with the mask in place, or with a finger closing the outlet of the control valve, small bubbles of gas will pass through the mercury and escape into the air. The inhaler is an adaptation of the dental inhaler of Forregger, consisting of an 8 inch rubber bag capable of withstanding 60 mm. mercury pressure. In the metal tube from the bag to the face piece, there is added a butterfly obturator valve. When this is closed there is no leakage from the bag except through the safety gauge. The dental face piece has been replaced by an infant face piece and rubber face mask.

Operation of the apparatus: Insert an infant rebreathing tube into the infant's mouth. Place the left palm up under the infant's back with the thumb pressing under the ribs over the stomach to prevent gas distending the stomach instead of the lungs. Tightly fit the mask to the face, having set the valve and distended the bag. Suddenly open the obturator valve allowing the pressure system to inflate the infant's lung. If the operator is not satisfied that this 8 mm. pressure is sufficient, the rubber tubing from the control valve can be pinched, the bag squeezed, and the lung distended in this manner. If respiration commences, leave the mask in place for five minutes; the pressure of 8 mm. in the apparatus is not sufficient to stop true respiratory effort. If in the period following the removal of the apparatus, after respiration has been apparently established, there should be cessation of respiration, proceed as before.

This apparatus has been used in 4 cases to date, and 3 of the infants have begun respiration promptly. In Case 2 there was a failure, the machine was not used until twenty-nine minutes of various methods

had failed to start respiration. This had been a difficult, long, breech extraction in a patient who had had 3 doses of morphine ¼ grain during the ten hours preceding delivery. All the other cases responded within 4 minutes after the effort to start breathing was begun.

In connection with this type of resuscitation it may be of interest to know that the apparatus used in the various emergency units of the Greater City of New York has been changed during the past two years from the Roth-Draeger pulmotor to carbon-dioxide-oxygen resuscitation.

TREATMENT OF BIRTH FRACTURES*

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THE obstetrician has to accept problems in dystocia not of his own choice, and though the highly civilized matron looks upon her contribution to the human race as a physiological function which should not be mixed with pathology, nevertheless, such admixtures are not uncommon; and when in the urgency of events, an obstetrician is unfortunate enough to meet with such a lesion as a fracture of the femur in the newly born, the problem of arranging for its care and protection is one of his added cares.

The pliable nature of the young bone, the lack of muscular development, the rapidity of healing, make for little displacement, seldom overriding, together with rapid correction of deformity and adjustment of length. Many simple procedures have been developed to handle the problem, all of which usually work well due to the basic conditions.

One more may not be amiss, especially where the case is either hospitalized or where relatives demand that an efficient looking appliance be secured. The device will do the following:

1. Suspend a child by the legs permitting traction by the weight of the body, as in the Bryant method.

2. Permit application and change of diapers and such care as the bowel movements and urine require.

3. Easy transportation of the child so that breast nursing is not interfered with. It can easily be made by any person of moderate skill from materials readily obtained.

The principles involved are the old Bradford frame half covered to support the body; an upright extension to maintain suspension support for the legs; a binder, a leaf of which goes about the body of the infant, another leaf which is laced to the frame and holds the body to the covered part of the frame.

The illustrations will serve to make plain the construction and application. The frame is preferably made of the 6 foot Bessemer steel rodding found in hardware stores, or round bar iron of a diameter best suited to the weight and size of the child. Quarter inch to 5⁄16 inch suitable for the base, the same for the uprights, and 1⁄16 inch for the piece which acts as a means of keeping the blanket off the feet. The different parts can be wired together with small copper wire and soldered, or the copper wire covered with adhesive plaster to make a firmer joint and prevent the twisted end of the wire from scratching. The height of the support for the legs (Fig. 1, B-C) should be long enough to allow 3 to 4 inches above the sole of the feet with the buttocks raised above the base of the frame. The frame is covered from A to B (Fig. 1) with wide adhesive plaster

applied transversely and lapped on the under side. This adhesive plaster is then brushed with melted paraffin to make it by safety pins, tapes, or this may be arranged as a Scultetus many-tailed bandage.
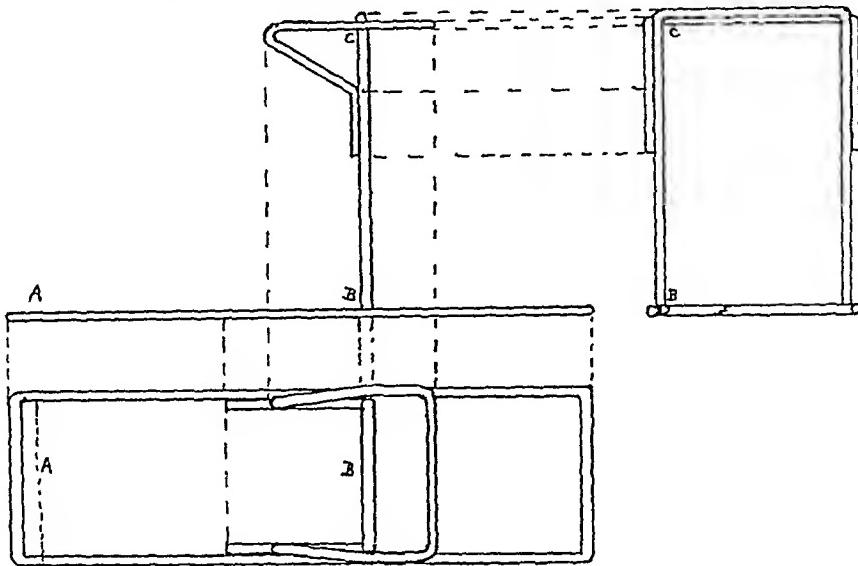
FIG. 1. Sketch of side, top, and end views of metal frame.

waterproof. The frame can be lacquered for the same purpose.

The next member is a binder made of two layers of unbleached muslin or strong canton flannel, each cut differently, and one super-imposed upon the other. These are stitched together at a point coinciding with the infant's back and for a width of 4 or 5 inches as shown by the lines D-E in the sketch (Fig. 2). The superficial layer of this binder is arranged for the body portion which is wrapped about the body from just below the anterior superior spines of the ilia to a transverse line extending across the chest about 1 or 2 inches below the anterior axillary folds. The upper portion tapers from the body piece and has two arm holes just above the latter. The cephalic end of this tapered piece has tapes upon it for tieing to the cephalic end of the frame. The wings should extend laterally to such a distance that when the body part is brought around the body of the infant with the arms through the arm holes, these wings will extend from the mid-clavicular line upward and form wing supports to each side of the head like a winged chair. The body portion is wrapped about the child, and may be held

The inferior or posterior leaf is made rectangular, wide enough to lap over the sides of the frame and long enough to support the head. Small eyelets are put
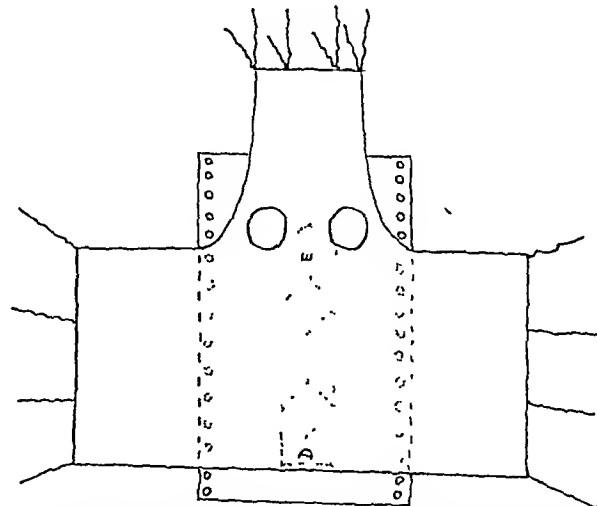
FIG. 2. Sketch showing outline of two leaves of binder, with body part superimposed on part which is laced to frame.

in the edges of the sides for lacing it along to the under surface of the frame over the adhesive-plaster part.

Adhesive traction straps are applied to the lateral surfaces of each leg, and carried over small spreaders. These

spreaders should not be any wider than the distance between the external and internal malleoli of each ankle. The

binder is tied to the cephalic end of the frame, so that the winged extensions support the head laterally as shown in Figure

FIG. 3. Infant with fracture of femur with frame adjusted.

FIG. 4. Infant in frame wrapped up and asleep.

spreaders are then attached to one transverse piece of splint which controls rotation of the lower fragment.

The body binder is placed about the child, the child is laid on the adhesive portion with such padding between the binder and frame as is deemed necessary. The legs are suspended by attaching the transverse wooden piece to which the spreaders are attached to the cross wire on the top of the suspension upright. The arms being through the arm holes, the body binder is wrapped about the child and fastened. The under piece is laced to the frame in the back. The upper end of

3. A diaper or pad can be adjusted beneath the buttocks of the child, and the whole placed on a pillow in the bassinet.

The frame without the upright for leg suspension and with lateral extension can be used for arm lesions, by fixing the baby to the frame with the binder.

It is well to make two binders, so that one can be laundered and changed when necessary.

A child in this apparatus is shown with a typical birth fracture of the femur in Figure 3. It could be nursed at the mother's breast, which the wings aided by supporting the head. The child was easily transported and changed.

PROLONGED RETENTION OF PLACENTAL REMNANTS*

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THE case presented in this article was under our care on the Surgical Service of the Fifth Avenue Hospital, and gave rise to considerable discussion

involving the possibility of retention of placental tissue in utero for a period of six years. The unusual nature of the condition from a medical standpoint, and

its importance from a medicolegal point of view led to the report which follows, along with a search of the literature.

Fig. 1. Photomicrograph of specimen in case of prolonged retention of placental remnants (high power). v, villus; c, calcification; n, necrosis.

Mrs. S. B., aged thirty-five, married, was admitted November 2, 1928 with a chief complaint of uterine hemorrhage. Her past history was irrelevant, excepting for the fact that she had had three pregnancies, with two living children, and had a miscarriage six years ago. Since that time her menses have been perfectly regular and normal. Coitus during this period was not denied. Her family history was negative. Her last menstruation occurred on October 4 but since then she had had some bleeding daily. On October 5 and off and on for two weeks she also passed clots. She has had no pain at any time, but complained of extreme weakness.

Physical examination revealed a uterus barely palpable above the pubis. Bimanually, the uterus was enlarged, softened, cervix slightly softened with softening of the lower uterine segment. There was no effacement, but the cervix was dilated sufficiently to admit the tip of the index finger. The adnexa were negative and the bleeding moderate.

The diagnosis made by two examiners was submucous fibroids and by one was incomplete abortion.

The operation was performed on November 3. The cervix was grasped with a tenaculum and brought down, dilated to one finger's

Fig. 2. Photomicrograph of specimen in case of prolonged retention of placental remnants (low power). v, villus; c, calcification; n, necrosis.

breadth and curetted with a sharp curette. Considerable material was obtained which had the appearance of placental tissue and was removed with some difficulty. Bleeding was profuse and the patient went into shock. Uterus and vagina were tightly packed and the patient received 800 c.c. of 10 per cent glucose intravenously and various stimulants.

She gradually improved and the packing was removed the next day. Bleeding was then very scant. She was discharged nine days later and the uterus found to be normal in size and position, adnexa negative, cervix closed.

Pathologist's Report. "Curettings consisted of a large amount of pale tissue, some rather firm, other fragments rather soft and spongy. Microscopical examination: Chorionic villi and decidual cells. Areas of necrosis and inflammatory infiltration. Paraffin sections confirm frozen section diagnosis and show also some calcareous deposits. Diagnosis: Inflamed placental tissue."

Discharge diagnosis: Retained placenta from incomplete abortion.

Follow-up examination one month later was negative.

The only history of recent pregnancy in this case was one of miscarriage at the third month, six years preceding admission, and the question arose as to the possibility of retention of placental tissue for such a long period of time. This led to a search of the literature and the amount of data available from this source was not very great.

In 1894, the subject received considerable attention from the profession resulting from a lawsuit (Kitson vs Playfair and wife)[30] involving persons of prominence in London society, and which is briefly summarized herewith:

The plaintiff, Mrs. Kitson, consulted her physician complaining of pains in the back, headache, sleeplessness, indigestion and vaginal bleeding. The history revealed that she had two children and five or more miscarriages, the last of which occurred in October, 1892. Her menses recurred in December, 1892 and were regular until the end of 1893 when she missed one or two periods. She had not seen her husband for twelve months.

The plaintiff's physician called the defendant, Dr. Playfair, in consultation. The uterus was found to be enlarged and the cervix partially open, and on curettage placental tissue was obtained. This was examined microscopically by J. Bland Sutton and declared by him to be recent placental tissue.

Dr. Playfair was related to Mrs. Kitson by marriage. He believed the tissue to have resulted from a recent abortion and threatened to inform his wife (Mr. Kitson's sister) unless Mrs. Kitson could prove that she had seen her husband within the preceding three months. This she could not do, with the natural consequences.

Mrs. Kitson then sued Dr. Playfair and his wife, and after considerable medical testimony, she was awarded a verdict of £12,000. Her verdict was won on two points:

1. The allegation of Dr. Playfair in regard to the plaintiff's infidelity was not sufficiently founded.

2. Dr. Playfair violated professional secrecy.

The testimony brought out many details involving prolonged retention of placenta, and for some time thereafter cases of similar nature were reported in the medical periodicals.

Commenting editorially on the subject of the pathologists' findings in the case, the *British Medical Journal* quotes an unnamed "well-known expert in uterine pathology" as follows: "Thus recent villi may look as though old, whilst even after very severe morbid changes around them, villi may appear perfectly new, though out of function for months. This is seen in well preserved polypi, where the microscope discloses well preserved villi though the date of the last pregnancy may be remote. The piece of placental tissue in such a case has taken root in the uterine wall and that kept its constituents alive."

Some of the cases reported in the literature subsequently follow:

Palmer[14] refers to a case of Dr. Trush in which prolonged efforts were made to deliver a full-term placenta, but they were unable to do so. There was no postpartum hemorrhage. The placenta was never delivered. The patient again became pregnant two years later with a repetition of the previous third stage.

Ross[3] reported the case of a woman who had had several miscarriages, the last occurring eleven months before. This was followed by amenorrhea. She then developed a profuse leucorrhoeal discharge which was offensive at times. The temperature rose to 100–101°, then returned to normal. The cervix was dilated and the blunt curette sank into soft placental tissue and blood gushed out. The tissue was still firmly adherent to the uterine wall. The uterus was curetted and the patient made a normal recovery.

Godson,[8] referring to the testimony of Sir John Williams in the Kitson-Playfair case, presented a case contradicting the latter's statement. Sir John's remarks follow: "In the case of a woman with retained placenta we would expect to find frequent and constant bleeding. Her periods would be irregular. We would not expect her to pass a period where there was no menstruation." Godson's case had an abortion at three or four months, eight months before. She had a long period of amenorrhea and then profuse bleeding. He removed what appeared to be an entire placenta.

Howard[6] described a case which miscarried August 4, 1890. On July 7, 1891, a mass protruded from the cervix which was a fourth month placenta. She had had a history of irregular flooding during this period. That the placenta had not been delivered was further indicated by the fact that her husband had buried the fetus in a cigar box and had noticed no placenta.

A number of other cases have been reported in the literature.

Newman[12] reports the case of a woman thirty-three years of age who had six children, the youngest two years of age. She had not had regular attendants at her last confinement and after weaning her child she menstruated regularly. On physical examination her uterus was prolapsed and subinvoluted, cervix eroded. On passing a sound the uterine cavity was shown to be 4 inches long. She remained under treatment for two months. At the time for her regular menses she flowed and two days later delivered a three-month fetus and membranes without the placenta. Severe hemorrhage followed, the cervix was dilated and the placenta delivered. Two days later she had another hemorrhage with hard uterine contractions and expressed a piece of placenta. Next day she bled again and expelled another piece which had undergone fatty degeneration.

Richmond[4] reports a retained placenta after a two-month abortion. She had had hemorrhage for one month and then menstruated regularly and finally expelled the placenta spontaneously.

Gallant[7] reported a case of miscarriage at the fifth or sixth month, flowing freely for two months afterwards and then the menses recurred regularly for seven months. Then followed two months' amenorrhea and when she consulted him she had been flowing continuously for four or five weeks. A fetus and sac were then passed and curettage produced a large amount of degenerated placental tissue.

Johnson[23] reports a case delivered by a midwife by whom he was called thirty-six hours later because of retention of placenta. It could not be expressed but under anesthesia about one-third of a normal placenta was removed. Stony hard areas were present and tore the operator's fingers when he attempted to remove the remainder of the placenta. This was therefore left undelivered and was not subsequently passed, but in spite of this she delivered a year later of a normal infant without complication.

Bartolemy[24] reports the retention of a placenta for four months without serious results. Fruhinsholz and Mariot report delivery of a living infant followed by a fresh and an old placenta. Wenning[15] reports the retention of one-fifth of a placenta for a year without ill effects.

Dietrich[26] reports a case of placenta accreta which died and was autopsied showing the eventual fate of cases of retained placenta. In two previous deliveries the placenta was delivered manually and in the last, part of the placenta remained behind. The posterior wall was entirely replaced by placental tissue and on the anterior wall there were some white indurated remains of a previous placenta.

Rucker[23] in an excellent paper on the subject, reports a case which he at first thought was one of prolonged retention of placenta, but apparently later felt otherwise. However, he made a rather exhaustive investigation of the subject with a complete survey of the literature. He reports a questionnaire sent to members of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons making inquiries on this subject. 143 replies were received . . . 112 replied that they had seen none. 31 replied that they had. The symptoms presented varied. Four had no symptoms. The majority had bleeding in some form or other, described as spotting, frequent menses, profuse menses and sudden hemorrhage. Cases in which large portions or the entire placenta were retained seemed to bleed less than those in which a small piece was retained. Fever was mentioned in 7 cases, vaginal discharge in 6, cramps in 1. Many of the cases were diagnosed as uterine fibroids. One case of retention of the entire placenta was reported. The patient never again became pregnant and went through the menopause without incident and at fifty-three years of age was in excellent health.

CONCLUSIONS

The case presented, which had had a miscarriage six years previously, and since had had regular menses, without omission, denied the possibility of a more recent pregnancy, was curetted and a large quantity of placental tissue was obtained.

However, she acknowledged having had coitus during this period.

The pathological findings of necrotic and calcareous areas in the placental tissue obtained indicated that the tissue had been retained in the uterus for a long time.

We believe this to have been a case of retention of placental tissue for a period of six years.

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THE ETIOLOGY OF PYELITIS IN PREGNANCY*

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PYELITIS as a complication of pregnancy was originally described in the middle of the 19th century but it was not until the end of the century that it was given any serious attention.

Simple pyelitis is almost universally recognized as being a secondary infection. In most cases it has its origin in foci of infection in the upper respiratory tract and its accessory sinuses, in infected teeth,

or in the gastrointestinal tract. Such pathology then should be carefully sought and cleared up as early in pregnancy as possible.

Of the predisposing factors in the gastrointestinal tract constipation undoubtedly heads the list. Some authors have expressed the opinion that as a result of intestinal stasis, there is an increased production of colon bacilli which eventually reach the kidney. Bacillus coli communis is the infecting agent in over 90 per cent of the cases. Occasionally streptococcus or staphylococcus are associated with the colon bacillus and very infrequently the gonococcus, pneumococcus or Bacillus typhosus.

Clinical evidence points to the probability of the infection reaching the kidney by way of the blood stream. However, it is a well-established fact that it is almost impossible to produce an infection in the urinary tract without some sort of obstruction. If the healthy resistance of the renal tissue is impaired by the damming back of urine from pressure on the ureter then conditions are favorable to the onset of inflammation in the area of lowered resistance. Its severity will depend on the virulence of the organism and the completeness of the obstruction.

That there is an obstruction in the urinary tract which precedes the actual symptoms of pyelitis during pregnancy is an accepted fact. How this obstruction occurs is still a much disputed question.

DeLee takes the stand that bacteriuria is found in a large percentage of cases of healthy pregnant women. He thinks this is probably due to constipation. The ureters, particularly the right, have been found dilated and filled with urine in about two-thirds of the gravidae coming to autopsy. This, he claims, is caused by torsion, stretching or kinking of the ureters due to the enlargement and dislocation of the pelvic organs, or the swelling of the bladder mucosa but not to compression, since the specific gravity of the pregnant uterus is about equal to that of the intestinal mass.

Owing to the stasis of the urine and the bacteriuria a pyeloureteritis is easily set up but infection can reach the parts also through the blood stream or lymph channels.

Hunner, on the other hand, believes that in all cases of pyelitis of pregnancy there has been a pre-existing stricture of one or both ureters. This narrowing, he feels, may be congenital or acquired. He is convinced that time and more careful study will prove that some of the congenital cases are caused by inflammatory processes derived through the placental circulation. However, by far the greater number are acquired, the origin being in some cases traumatic, that is from an injury at operation or childbirth, or from pressure from tumors. A large number are associated with cancer of the cervix. A few are syphilitic. A simple inflammatory stricture due to focal infection in some other part of the body is overwhelmingly frequent when compared with stricture from all other causes. Hunner is convinced that the stricture usually originates from some focus of infection.

Hunner's work has gone far to revise opinions on the cause of the urinary stasis which undoubtedly exists in these cases. But to date the vast majority feel that the actual cause in most cases is pressure on the ureters by the pregnant uterus. Two or three outstanding facts have influenced many persons in this conviction: First, in 80 per cent of cases the pregnant uterus during its growth is deviated to the right side of the abdomen and is twisted on itself from left to right. The reasons for this dextroversion and torsion do not belong in the compass of this paper but may be found in any textbook on obstetrics. Second, in pregnancy there is a constant right-sided ureteral dilatation, the left ureter and pelvis usually escaping this dilatation, and a consequent more frequent occurrence of right-sided than of left-sided pyelitis. The knee-chest position in pregnant women with pyelitis frequently will give complete and lasting relief. The con-

clusions drawn by the adherents to this theory are that the ureter is compressed at the brim of the pelvis by the pregnant uterus, the urinary flow is obstructed, the urine becomes infected and pyelitis results.

Duncan and Seng, reporting a series of cases at the Royal Victoria Hospital, have demonstrated the hypertrophy and hyperplasia in the ureters during pregnancy and believe the factors responsible for this tissue change are (1) increased vascularity in the cervix and parametrium with the consequent production of congestion, (2) pressure from general pelvic overcrowding by the growing uterus, and (3) a marked congestion and distortion of the vesical trigone.

They believe that stasis, as measured by the inability of the renal pelvis and ureter to empty themselves within normal time limits, is a definite and universal finding in antepartum women.

Hofbauer, of Johns-Hopkins, after microscopic study of the parametrium in a series of 43 specimens obtained from pregnant women, reports the constant finding of a phagocytic tissue which appears at the base of the broad ligament during pregnancy. This is intensified by long labor and by the existence of infection.

Corbus and Danforth, stimulated by Hunner, have studied a series of cases at the Evanston Hospital and are convinced that the obstructive pathology is present before pregnancy begins. Termination of pregnancy in no case cured the urinary infection.

Rosenow is of the opinion that the first lesion is in the kidney parenchyma. Craig, on the other hand, adheres to the theory that the cause of the stasis is pressure of the uterus on the ureter where it enters the pelvis.

According to Waldeyer the bladder is displaced downward owing to the pregnant uterus. At a result of this downward displacement the ureter becomes kinked or narrowed at the point at which it crosses the bony pelvis. Urinary stasis and dilatation follow.

One of the most interesting phases of this subject has been the discussion of the route travelled by the infecting organism in reaching the kidney. Three possibilities generally considered are hematogenous, lymphogenous and urogenous.

(1) *Hematogenous Route.* The theory that colon bacilli are transplanted by the blood stream is the belief of most authors today, although in comparatively few instances has it been possible to isolate the bacilli from the blood stream. Widal and Bernard report 2 cases of pyelonephritis of pregnancy in which they isolated colon bacilli from the blood and urine.

(2) *Lymphogenous Route.* Since the work of Francke, who made an exhaustive study of the lymphatics of the large bowel, the lymphatic route of infection has received a good deal of consideration. He was able, by injecting the lymphatics of the large bowel, to prove that the lymphatics on the right side pass over the capsule of the kidney. According to Stahr the lymphatics of the kidney capsule communicate with the deep lymphatics of the kidney. Francke believes, therefore, that there exists on the right side and probably on the left communication between the large bowel and the kidney by way of the lymphatics.

(3) *Urogenous Route.* It was proved many years ago by Goldschmidt and Lewis, Markus and others that under certain conditions antiperistaltic movement may take place in the ureter, causing the contents of the bladder to be propelled into one kidney. Even a partial filling of the bladder suffices to obliterate the closure of the ureteral orifice, the result being that each variation in the intravesical pressure is transmitted to the renal pelvis.

By means of a series of cystograms made in normal persons by filling the bladder with various solutions opaque to roentgen rays Kretschmer was able to demonstrate regurgitation in both normal and pathologic bladders.

SUMMARY

In summing up, the conclusions arrived

at from the literature studied are as follows:

1. Pyelitis of pregnancy is usually found in the right kidney in the middle three months of the first pregnancy of patients of twenty-five years or younger.

2. It is usually a secondary infection with Bacillus coli communis the infecting organism.

3. Urinary stasis is a necessary accompanying factor.

4. This stasis is generally believed to be produced by pressure exerted by the pregnant uterus on the ureters at the brim of the pelvis.

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CONSERVATIVE SURGERY IN RENAL LITHIASIS*

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NEW YORK

VARIOUS factors during the past several years have been responsible for an increasing conservatism in the surgery of kidney and ureteral lithiasis. Surgeons are more and more reluctant to sacrifice in part or in whole even considerably diseased kidneys, if by any reasonable means such kidneys may be safe to the body economy. If infection is overcome and good urinary drainage established, we have no accurate means of determining how great a comeback a kidney may make.

Beer's temporary hemostasis by means of a rubber tube clamped around the kidney pedicle has enabled us more accurately and with greater ease to explore a kidney and remove difficult and multiple stones, stones which a decade ago would have been untouched, left in place.

Some time ago we were very reluctant to do a nephrotomy for stones impossible to remove in any other way, viz. the large branched calculi occupying the entire kidney pelvis. We feared the bleeding and used through-and-through mattress sutures to control the bleeding. Such sutures destroyed the kidney tissue in which they were placed. Denning's fine research has taught us that we can do a nephrotomy with impunity and if we place our sutures near the margin of the incised kidney we can control the bleeding and run no risk of damaging, to any marked degree, the kdiney function.

Quimby's perfection of the technique of the taking of roentgen-ray pictures of the kidney on the operating table has enabled us more accurately to remove all kidney stones at one operation. Fewer stones are now left behind.

Kidney surgery under spinal anesthesia

has, I believe, made operation less hazardous. When the anesthesia works, it lasts about one hour and the relaxation of the

excretory function after the removal of its fellow. On the other hand, if both kidneys are reduced in function and it is

FIG. 1.

FIG. 2.

abdominal muscles is greater than under general anesthesia.

If the operation is to take longer than an hour, spinal anesthesia must be supplemented by general anesthesia. This complicates matters. The surgeon ought to be able to determine, in most cases, the probable length of a given operation and choose the anesthetic accordingly. I have done one nephrectomy for a large kidney tumor under spinal anesthesia. The anesthesia was perfect, so extensive operation and the large size of the kidney does not contraindicate spinal anesthesia.

At the present time, our knowledge of the various gradations of renal function and the ability of a kidney to do the body excretory work after the removal of its fellow diseased kidney is quite imperfect. If the kidney which is to remain excretes dyestuff (phenolsuphonephthaline, indigo carmine) normally, then we know that kidney is capable of doing the total body

FIG. 3.

necessary to remove one, a circumstance not often occurring, we can but guess as to

the possibility of the remaining kidney carrying on the body work. Such a problem arose in the following case:
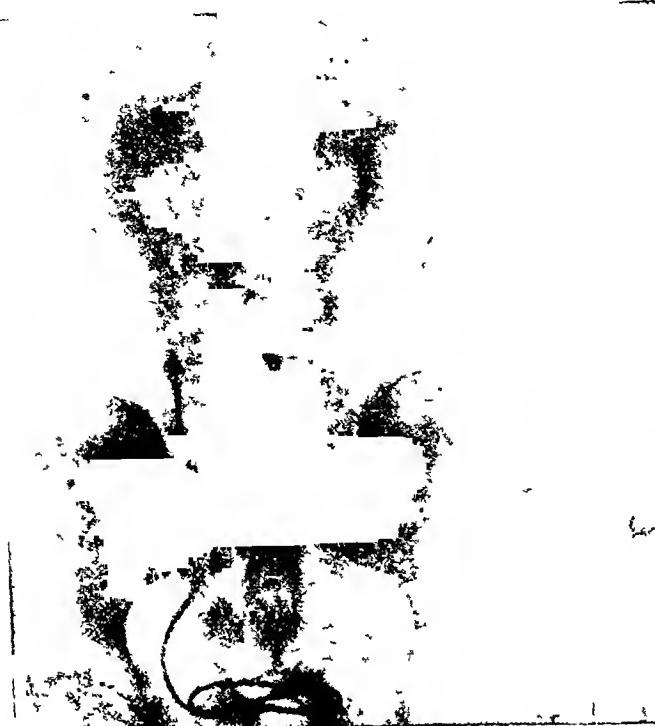
FIG. 4.

FIG. 5.

dilated half way up (at least with the ureter catheter curled up in it). A shadow showed in the lower end of the left ureter, lying on the
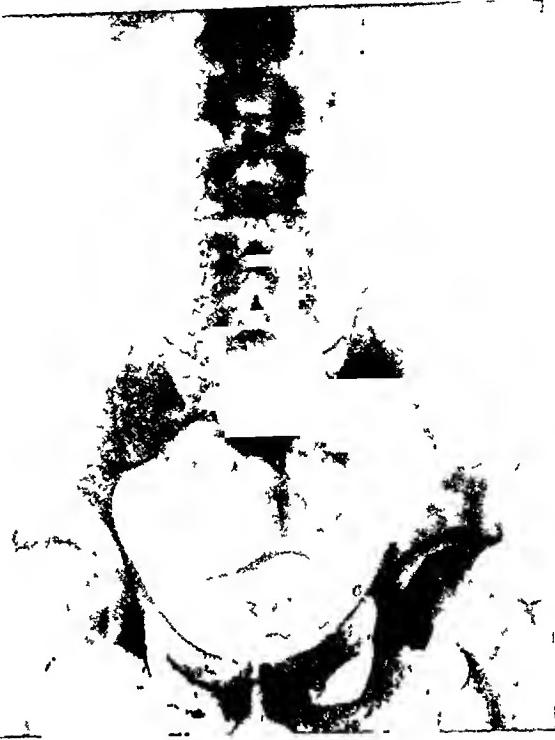
CASE I. This patient, A. S., aged forty-seven, came to the hospital with the history of pain of several weeks' duration over the right kidney region.

His urine was cloudy with pus, he had but little temperature, his blood urea was 20 mg. per cubic centimeter and he did not look well. He was cystoscoped. An inflamed and ulcerated bladder was found, not particularly suggesting tuberculosis. Both ureters were catheterized, the right ureter with difficulty, the catheter stopping about half way up the ureter. The left catheter went up to the kidney pelvis easily. The right catheter began to drain thick pusy urine, while the urine from the left catheter showed more normal urine. Intravenous indigo-carmine was but little delayed in its excretion time on the left side while none was excreted up to fifteen minutes on the right.

A plain roentgenogram and a right pyelogram were attempted with the result shown in the Figures 1 and 2.

Thus we had, on the right side, a kidney badly damaged, excreting much pus, with a ureter strictured at the bladder end and much

ureteral catheter, which was presumably a stone. The patient was recystoscoped. This time relatively thick pusy urine was seen coming from the right ureter. Both ureters were catheterized and an intravenous phenol-sulphonephthalein injection given. Red did not come from the left ureter until twenty-one minutes after injection, indicating a grave disturbance of the function of the left kidney and not entirely agreeing with the previous examination. We therefore decided to make a pyelogram of the left kidney, with the results shown in Figures 2 and 3.

The quantity of urine excreted from the right kidney was 5 c.c. with urea of 0.4 per cent while 4.4 c.c. were excreted from the left with urea of 1.2 per cent. So roughly quantatively the right secreted 2.0, while the left secreted 5.28, the left being about three times as good as the right but the right doing an appreciable part of the combined kidney work. We, therefore, had a badly damaged right kidney with at least one stricture of the ureter, which stricture has been sufficiently overcome to enable the kidney to drain fairly well. There was a less damaged left kidney with a

stone in the lower ureter. Notwithstanding the low blood urea, I believed that the removal of the right kidney would result in the patient's

FIG. 6.

death from uremia. We therefore for a time at least had to temporize. We are at present pushing the patient's water intake and further dilating the ureters. If and when the patient's condition allows, the first move should be to remove the stone from the lower left ureter. How much the function of the kidneys will improve on dilatation of the ureters, remains to be seen.

Case II illustrates how very faulty our estimate of kidney function may be when a kidney is temporarily and partly blocked by a ureteral stone. If we had followed our exact data as to kidney function we might have removed a kidney (left) which after conservative operation functioned normally.

CASE II. A male patient, forty-nine years of age, came with only a week's history of severe pain in the right flank radiating to the right groin. He came to the hospital and was cystoscoped. A catheter was easily passed up

the right ureter while that up the left ureter met an obstruction at $2\frac{1}{2}$ cm. Normal urine came from the right kidney with blue excretion three minutes after intravenous injection of indigo-carmine. None came from the left catheter for one hour and a very small amount of blue fluid was obtained from the bladder at the end of this hour. This lack of function of the left kidney was checked up at another cystoscopy.

Roentgenogram showed a right fairly large ureteral calculus at the level of the third and fourth lumbar vertebrae. There were two or three shadows in the right kidney which were suspicious of calculi. There was a large renal calculus in the pelvis of the left kidney. In the lower end of the left ureter there was a fairly large calculus $1\frac{1}{2}$ inches long, filling the lumen of the ureter.

From our observation, the right kidney was at least functioning normally, but its function was endangered by the ureteral calculi. Notwithstanding the fact that we obtained no function of the left kidney, because of the lack of previous history we had an idea that there might be a fairly good kidney there.

The stones of the right ureter were taken out without trouble. When this wound was healed and the right ureter working well, we decided to tackle the left ureteral stones which were removed with considerable difficulty because they were practically all in the intramural portion of the ureter. These were removed and a free passage obtained into the bladder. The patient was in good condition so we rapidly and easily removed his kidney pelvis stone through a pyelotomy incision. The kidney looked entirely normal. Both wounds healed up without trouble.

Before the patient left the hospital it was found that the function of his left kidney, which previously according to our examination had no function, was normal.

He has lately come back to the hospital and a roentgenogram, pyelogram and gall-bladder series indicate that he probably has gallstones and a few small right kidney stones. We are going to keep dilating his ureter, sterilizing his kidney pelvis and see if he will not pass some of these stones. The sites from which the stones were originally removed showed no calculi.

This third case shows how a comparatively small stone of a kidney calyx can

cause a temporary reduction of kidney function. The increased function after the removal of the stone was surprising.

Case iii. F. C., female, aged twenty-nine years, came to the Fifth Avenue Hospital with a history of attacks of general abdominal pain and vomiting.

Her physical examination revealed nothing but a moderate amount of tenderness on pressure over the left costovertebral angle.

A roentgenogram revealed in the lower calyx of the left kidney a small stone ½ inch long by ¼ inch broad.

The cystoscopy before operation November 7, 1928, revealed that the time excretion of phenolsulphonephthalein after intravenous injection from the right kidney was three minutes and from the left kidney was twenty minutes. No other comparative test of the renal function was made.

The patient was operated upon and through a nephrotomy wound, a small stone was removed. Some difficulty was encountered in finding the stone. The recovery was uneventful.

A cystoscopic examination after operation, December 1, 1928, showed that after intravenous injection of phenolsulphonephthalein red appeared from the right kidney in three minutes and from the left kidney in three minutes. The percentage phenolsulphonephthalein and percentage urea at this examination indicated that the left kidney was apparently functioning better than the right. This increase in functional capacity on the part of the left kidney is hard to explain after the removal of so small a stone.

The patient was admitted about a month later acutely ill and died shortly with a diagnosis of bronchopneumonia. Autopsy showed acute yellow atrophy of the liver. There was apparently no relation between the kidney condition and this.

A CASE OF INTRACANALICULAR FIBROADENOMA OF THE BREAST WITH ASSOCIATED TUBERCULOUS LYMPHADENITIS MISTAKEN FOR CARCINOMA*

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THE concurrence of tuberculosis of the breast with carcinoma of that organ has been extensively studied. Klose reported 17 cases personally observed. Other German authors, Bauer, Bundschuh, Franco, Fricke and Scheidegger have detailed such conditions. From the French literature are the cases of Hartmann and Massabuau, while Rodman, Smith and Mason, Deaver and McFarland have published histories of similar conditions. In many instances the axillary nodes revealed metastatic mammary carcinoma and tuberculous lymphadenitis. Leicher called attention to tubercular nodes in the cervical regions mistaken for metastases from laryngeal, pharyngeal and lingual carcinoma.

An unusually interesting case reported by Walther has no direct similarity to the present one but shows multiple lesions in the same breast.

The specimen was from the breast of a woman thirty years of age. The lesion was noticed ten months prior to operation but in addition a second nodule appeared near the periphery of the breast, which grew rapidly, finally causing redness of the skin. There was

a tumor in the external portion of the breast the size of a lemon, freely movable and nodular, apparently an adenoma, but a smaller nodule

adenoma but the mode of infection was not determined.

The only case in the literature which

FIG. 1. Intracanalicular fibroadenoma of breast with excess of stroma compressing cellular elements

FIG. 2. Section of another portion of tumor showing alveolar arrangement of acini.

near the areola was considered a scirrhous carcinoma. Microscopic examination revealed a fibroadenoma in parts, a cellular carcinoma in others and a small but typical area of tuberculosis. The axillary lymph nodes were entirely replaced with cancer.

However, the incidence of tuberculosis of the axillary lymph nodes with benign lesions of the mammary gland has appeared to be a rare occurrence. Jehn, in reporting the results of the autopsies upon 84 patients with tuberculous axillary lymphadenitis, found no benign breast tumors. A similar study by Prym fails to mention these co-existing conditions. Davis reported the case of an adenoma of the breast which, during pregnancy, became infected with tubercle bacilli. Axillary dissection failed to show invasion of the lymph nodes and he concluded that the case was one of primary involvement of an

appears similar to the one under report is that of Ravel. From his study he felt that all adenomas of the breast are of inflammatory origin and concluded that a fibroadenoma of the mammary gland associated with tuberculous axillary nodes was of tubercular origin. The discrepancy in this case was not commented upon for the nodes appeared subsequent to the discovery of the tumor. Most cases of tuberculosis of the breast are felt to be secondary to a primary focus elsewhere and when the mammary lesion develops secondary to axillary nodes it is concluded that the infection is retrograde (Duvergey). But the case which is the subject of this communication had neither tuberculous mastitis nor was the adenoma involved in a tubercular process.

Mrs. M. M., an Italian housewife, aged twenty-eight, was admitted to the service of

Doctor Frederic W. Bancroft on November 24, 1918. She had been observed one week prior to admission because of pain in the right shoulder, present for two weeks. A few days after the onset of pain several discrete masses were felt in the right axilla.

The patient's parents had died of causes which could not be ascertained. Three brothers and two sisters were living and in good health, as was her husband.

The past history was singularly free of significant or relevant complaints. There had been no pregnancies though the patient had been married for four years. Menstruation was normal and the breasts had never caused any trouble. She had influenza during the epidemic of 1918. A recent cough of three weeks' duration had been productive of occasional blood-tinged sputum.

Physical Examination. The patient was a well-nourished woman with no obvious anemia. Her weight was 148 pounds, 8 pounds below her average weight. There was no hyperpyrexia and only localized adenopathy. The examination revealed only positive findings in the right breast, axilla and the lungs. The breasts were well developed and moderately pendulous. The nipples and arcolae were normal, on a level and equidistant from the midline. The left breast and lymph drainage areas were without positive findings. In the right breast to the outer side of the areola a small, slightly tender mass 2 cm. in diameter could be palpated. This was discovered on examination but the patient was unaware of its presence. There was no skin retraction nor dimpling and the tumor was not adherent to the deeper structures. Low in the pectoral region was a resilient, non-adherent lymph node 2 cm. in diameter and four larger ones, 4 cm. in size, were palpated in the axilla. These masses were not tender.

Examination of the chest showed expansion equal, regular, and without marked apical retraction. There was dullness at the right apex extending down to the fifth rib and slight dullness at the left apex. On auscultation diminished breath sounds, bronchovesicular breathing and occasional moist rales could be heard at the right apex. A bronchovesicular quality of the breath sounds was noted at the left apex.

A tentative diagnosis of fibroadenoma of the breast and tubercular axillary nodes was made.

But complete blood studies and a rontgenogram were requested.

The blood findings were:
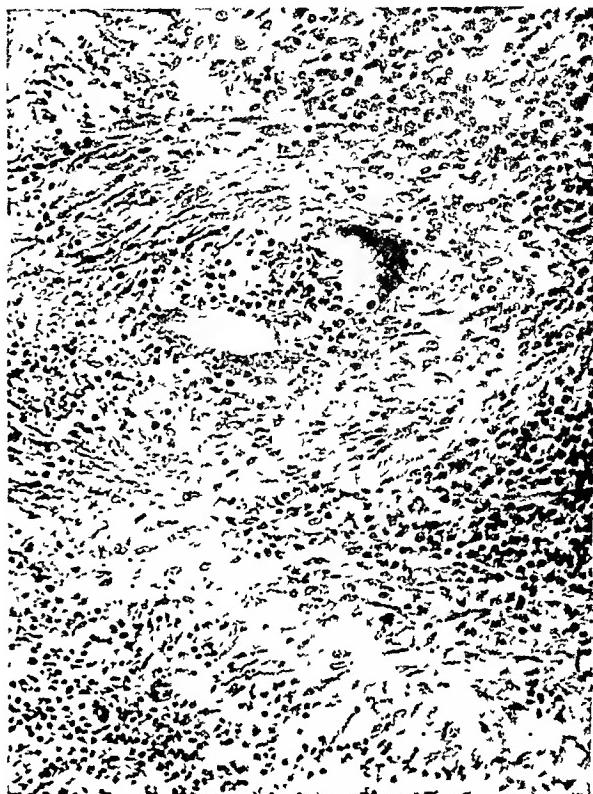
FIG. 3. Section from lymph node showing tubercle with typical giant cell, fibroblasts and caseation.

HB.	85 per cent
R.B.C.	4,200,000
W.B.C.	10,000
P.M.N.	67 per cent
L.	31 per cent
Eosinophiles.	1 per cent

The blood chemistry was normal and the Wassermann reaction negative.

Roentgenological Report. Dr. Lewis Gregory Cole and Dr. Robert E. Pound gave the following interpretation of the chest plate: "Film of the chest shows an infiltrative lesion throughout the upper half of the right chest and the left apex. The left apex shows numerous calcifications, while the infiltration in the upper right chest is of the soft type. I believe that this is a tuberculous process and active at the present time."

With these findings the tentative diagnosis seemed corroborated but a carcinoma of the breast was considered possible, and this was the preoperative diagnosis made by Dr. Donald Gordon.

Operation. On November 28, 1928 a simple mastectomy and axillary dissection were performed under ethylene anesthesia. Frozen section showed the nodes to be of tubercular origin and the breast tumor an intracanalicular fibroadenoma.

Postoperative recovery and wound healing were without incident.

Pathological Report. Dr. D. S. D. Jessup reported on the pathology of the specimen:

"Macroscopical Examination. First specimen removed for frozen section is a node 1 by 1½ cm. in size and on section is filled with caseous material. The breast is 16 by 13 cm., nipple not retracted. About 3 cm. from the nipple and below the deep fascia is an encapsulated nodule 3 cm. in size. Section for diagnosis taken from this point. About 3 cm. from this nodule is a smaller one about 1 cm. in size, which is also encapsulated and is fibrous on section. The axillary nodes, removed with the breast range in size from 2 to 4 cm. They all present much the same picture as the one removed for frozen section. Some of these have only a capsule of node left and are entirely filled with caseous material.

Microscopical Examination. The breast tumors show a growth of dense fibrous tissue between the acini and bulging into the tumor, spreading some of them out into narrow channels. Sections of the lymph nodes show tubercle tissue with large caseous areas."

Pathological Diagnosis. Intracanalicular fibroma of breast; tuberculous axillary lymph adenitis.

Subsequent careful examination of the specimen failed to reveal any focus of tuberculosis in the breast.

The axillary nodes in this case were probably the secondary manifestations of the pulmonary infection. It was reasonable to suppose, in view of the considerable literature upon the subject, that without surgical intervention the breast itself might have been involved in a secondary tuberculous mastitis. Most authors have agreed that secondary tuberculous mastitis has resulted from a retrograde embolic process through the lymphatics. We may presume that the early operation precluded such involvement.

The tentative diagnosis was correct, but the preoperative diagnosis in this case *proved to be erroneous.*

It is a well-established fact that bulky carcinomatous axillary nodes may be found without evidence of a primary mammary lesion or with a small insignificant focus of cancer in the breast. Malignant tumors of the breast in young women are quite formidable and of a high index of malignancy. We felt that we might have been dealing with such a condition in this patient, who was only twenty-eight years old, having a small mammary tumor and large axillary nodes. However, the axillary adenopathy with such findings in the breast in the presence of active pulmonary tuberculosis might have led one to the conclusion that the nodes were of tubercular origin. With such a setting, in future cases the more justifiable procedure would be an axillary dissection to determine the character of the nodes, followed by a local excision of the mammary lesion if the nodes proved to be tubercular.

HOSPITAL FOR RUPTURED & CRIPPLED

Sixteenth Annual Meeting of the Alumni, New York, November 19–20, 1928

THE PATHOGENESIS OF LEGG-CALVÉ-PERTHES' DISEASE BASED UPON THE PATHOLOGIC FINDINGS IN A CASE*

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DESPITE the extensive literature that has accumulated concerning Legg-Calvé-Perthes' disease, very few specimens of it have been available for pathological study. Zemansky,[1] about one year ago, was able to collect only 11 histologically studied true cases in addition to his own, and 3 of these represent merely tissue fragments removed at operation.

While the pathological findings in these reported cases showed sufficient conformity to identify the major disease criteria, there still remains much to be learned of the disease picture, and its pathogenesis is as mysterious as ever. For these reasons, additional pathological studies are of great importance.

There is, however, an additional factor of interest associated with the case to be herewith presented. In ten of the twelve previously reported studies no mention of the round ligament is made, while in the other two it is specifically stated that no trace of the ligament could be found on the specimen. We have been fortunate in this case to have, for the first time, the round ligament available for pathological study.

This specimen was obtained through the kindness of Dr. Samuel Kleinberg from the service of Dr. Royal Whitman at the Hospital for the Ruptured and Crippled. The clinical history follows:

I. K., aged twelve years, admitted Dec. 19, 1927, because of pain in the left hip joint and limp.

History. Six months ago this child was sitting in a chair with the left lower extremity doubled under her. When she tried to rise she complained of sudden pain in her left hip. The pain persisted and it was noted that she limped. She was then treated for two months in bed by the family doctor but apparently there has been no improvement in the condition since she still complained of discomfort about the left hip and the family noted a persistent limp.

Examination. Examination showed a large overnourished girl of twelve years, weight 127 lbs., height 5 ft. She walked with a limp on the left lower extremity. On the table it was seen that there was slight atrophy of the left thigh and the extremity was obviously a little shortened and was held in position of abduction, about 5 to 10° and abduction was entirely restricted. Inward rotation likewise rather moderately restricted. Flexion was restricted at 100° and hyperextension exaggerated a little beyond normal.

R.U. 35¾	L.U. 34½
R.A. 30¼	L.A. 30
R.C. 13¼	L.C. 13
R.T. 17¼	L.T. 16¼

Diagnosis. Epiphyseal separation of the left hip joint. To have roentgen-ray examination and be admitted to the hospital for correction of deformity.

[1] Zemansky, A. P. Jr. Pathology and pathogenesis of Legg-Calvé-Perthes' disease. Am. J. Surg., N.S., 4: 169, 1928.

* Read at the Sixteenth Annual Meeting of Alumni of Hospital for Ruptured & Crippled, N. Y., Nov. 19–20, 1928.

Dec. 10, 1927, Dr. Whitman. This patient was very much overweighted and the development seemed to be very advanced and some-

FIG. 1. Sketch of specimen as received. Anterior to fringe of capsule can be seen a furrow in surface cartilage. Round ligament appears enlarged and protrudes stiffly from fovea capitis.

what of the endocrine type. She walked with a marked limp on the left side. The left limb was practically extended, flexion limited at about 120° and accompanied by outward rotation. Abduction completely restricted. Rotation restricted about one-half.

R.A. 31   L.A. 30¼

Roentgenogram showed that the upper epiphysis as compared with the normal was very much flattened and somewhat irregular and had apparently been displaced backward on the neck of the femur.

Dec. 19, 1927. Dr. Whitman. Reconstruction operation right. The joint was opened by the usual incision. It was then found that there had been no epiphyseal displacement but that this was an early stage of Legg-Perthes' disease of the "cap type." The head was flattened and the cartilage extended outward to the neighborhood of the trochanter. The ligamentum teres was found to be thick, red and swollen. The epiphysis was removed together with all the

cartilage. The extremity of the neck was filed to a smooth and rounded extremity. The acetabulum was normal except that at the point
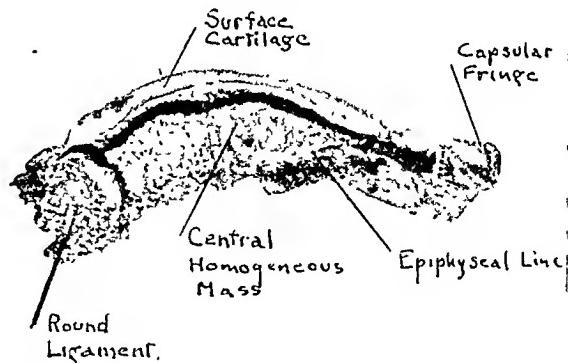
FIG. 2. Photograph of cross section of specimen showing homogeneous central mass and enlarged ligamentum teres.

where the ligamentum teres was attached there was a marked congestion and thickening of the soft tissues. The trochanter was transplanted in the usual manner and plaster spica was applied.

EXAMINATION OF SPECIMEN

Macroscopic Appearance. The general contour of the femoral head was fairly well preserved although it extended outward toward the trochanter more than is normally the case. The crest was distinctly flattened. The surface cartilage was clear and white but marked with superficial indentations and grooves as if in accommodation to a shrinking of the underlying substance. One deep furrow, parallel to and anterior to the capsular insertion extended across the anterior surface and continued, more shallow, across the top.

The round ligament protruded stiffly from the fovea capitis as in the illustration (Fig. 1). It measured about 12 mm. in diameter at the site of insertion, was deep red in color, markedly injected and edematous.

Technique. The specimen was fixed in 10 per cent formalin for one week. It was then divided and sawed vertically into four sections of equal thickness. The blocks for microscopic section were cut from these divisions. Paraffin was used for imbedding.

Appearance of Cut Section. The surface cartilage was, with minor variations, of uniform thickness and normal appearance.

a vascular system could be identified. Figure 3 illustrates the extent of this massive necrosis.

Fig. 3. Low power photomicrograph of typical tissue removed from necrotic area. Bone lacunae are all empty and lamellae are separated by a mass of homogeneous debris in which all cell structure is lost.

Fig. 4. Reaction zone between healthy bone which adjoins round ligament insertion and area of necrosis. A. Healthy bone. B. Necrotic bone. C. Reaction zone.

Similarly, the epiphyseal line appeared normal and unbroken with the exception of one area in the third block. In this block, the continuity of the epiphyseal line was broken about 1 cm. from the trochanteric margin. The interruption extended for approximately 3 mm. in the center of which appeared a small cartilaginous island. The bone lying between the surface cartilage and the epiphyseal line was yellow in color, in contrast to the normal bone under the epiphyseal line, which was red. The bony lamellae of the epiphysis were of normal appearance except for an area in the central portion, where they appeared to be compressed into a mass of debris (Fig. 2).

Microscopic Appearance. Microscopically, the surface and epiphyseal cartilages were normal in every way. However, the greatest part of the spongiosa of the epiphysis consisted of a necrotic mass. The bone lacunae in this area were all empty and the marrow was converted into a homogeneous mass in which all cell structure had disappeared. No red blood cells or remains of

Proceeding downward to the area directly above the epiphyseal line, a few islands of normal bone and marrow could be seen. In these areas the bone lacunae contained well stained cells, and were covered with osteoblasts. These islands merged gradually into the necrotic tissue directly above.

Approaching the round ligament and about 6 mm. from its insertion into the femoral head, the end of the necrotic tissue was encountered. It was here bordered by a thin wall composed of vascular mesenchymatous tissue in which polymorphonuclear leucocytes, small lymphocytes, plasma cells and giant cells are plentifully scattered. In this area, the bone lamellae were thickly covered with osteoblasts and there was evidence of rapid new bone formation (Fig. 4).

In the space between the thin reaction zone and the fovea capitis, the spongiosa appeared entirely normal. Several marrow capillaries in this area were markedly thickened. This finding will be dealt with in association with the round ligament vessels.

Approaching the trochanter, the necrotic

mass extended to the end of the spongiosa, *i.e.*, the junction of the epiphysis with the surface cartilage.
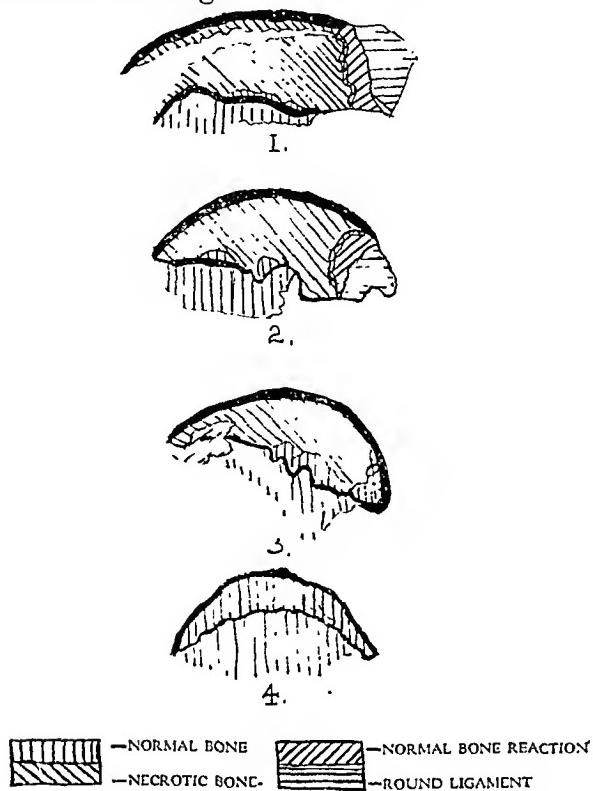
FIG. 5. Diagrammatic sketch showing distribution of lesion in four sections.

not to warrant a separate report. The slight difference in the distribution of these changes may be observed in Figure 5.

Block three was of more interest because in this section occurred the only spot in which the epiphyseal line was no longer intact. Microscopic examination confirmed the shape and characteristics of this rupture as described in the gross examination. Through this break, separating the healthy bone below from the necrotic tissue above, could be seen a dense growth of mesenchymatous or granulation tissue resembling closely that tissue bordering the necrotic mass on the ligamentous side. This tissue harbors inflammatory cells identical with those observed in the reaction zone on the side of the ligament. It is moderately vascular and is rapidly producing new bone of the "appositional" type (Fig. 6).

Block four showed bone and cartilage throughout to be normal in every respect.

The accompanying diagram (Fig. 5) illustrates the distribution of the above described changes.

THE ROUND LIGAMENT

Technique. The round ligament was

FIG. 6. Rupture in epiphyseal cartilage filled with vascular mesenchymatous tissue and newly formed cartilage and bone. Clusters of leucocytes can be seen scattered in tissue. A. Epiphyseal cartilage. B. Mesenchymatous tissue.
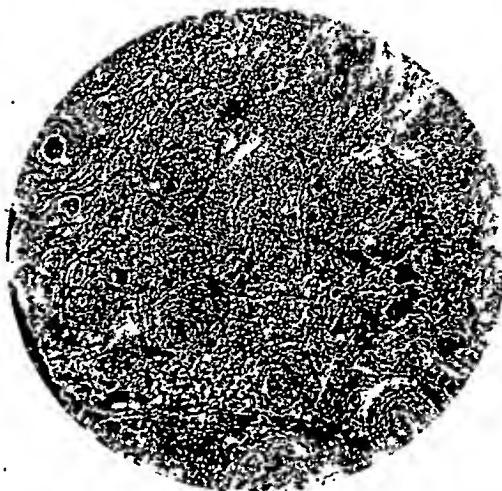
FIG. 7. Low power photomicrograph of tissue in peripheral portion of round ligament. Structure appears edematous. Most of arteries are thickened and several are completely obliterated. Perivascular infiltration can also be observed about most of arteries.

The second block to be examined showed changes so similar to those of block one as

fixed in formalin for one week, imbedded in paraffin and cut transversely. Sections were

stained with hematoxylin eosin, Weigert, Van Gieson, Fibrin, Sudan III, methylene blue, Goodpasture and Mallory stains.

Microscopic Appearance. Edema and hemorrhage characterized every portion of the ligament observed. The tissues throughout were widely separated and permeated with extra vascular red blood cells (Fig. 7).

The periphery of the ligament, especially on one side, was composed of loose areolar tissue suggestive of granulation tissue harbor a network of capillaries. Some of these capillaries are old and show retrogressive changes (new elastica formation and endothelial proliferation). A few of them are completely obliterated. Others are unquestionably newly formed. Several of the thickened capillaries are surrounded by an infiltration of cells. These are mostly round cells but there are also many polymorphonuclear cells and occasional plasma cells. No thrombi were seen in any of the vessels.

SUMMARY

These essential microscopic findings thus observed may be summarized as follows:

Femoral Head. 1. There is a massive subchondral bone and marrow necrosis extending from the surface cartilage to the epiphyseal plate involving approximately half of the femoral head spongiosa.

2. This mass is bordered in places by a mild reaction zone composed of vascular mesenchymatous tissue in which small round cells, polymorphonuclear leucocytes and occasional plasma cells are scattered.

3. The epiphyseal line is intact except for one small break in continuity where a similar reaction tissue appears.

Round Ligament. 1. Edema and diffuse hemorrhage involve the entire structure.

2. The blood vessels of the ligament show obliterative thickening and many of them are surrounded by a cellular infiltration.

3. On one side of the ligament appears

fresh granulation tissue harboring many distended capillaries.

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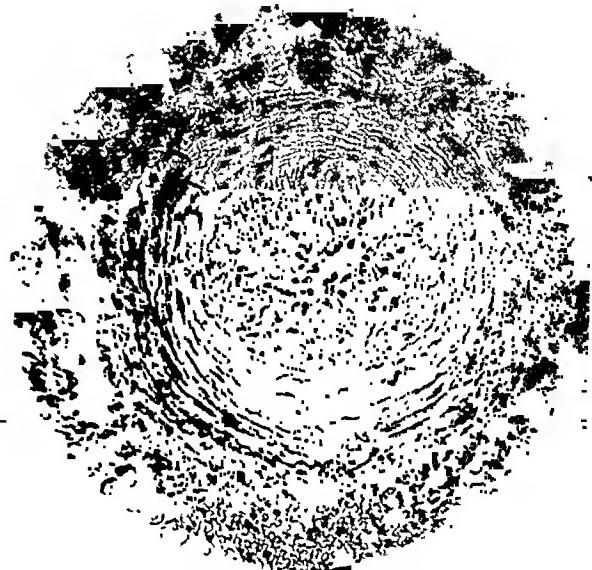
FIG. 8. High power photomicrograph of round ligament artery showing obliterative thickening.

DISCUSSION

The femoral head findings just described identify this specimen as that of an early Perthes' disease; the 13th pathologically described case found in the literature.

Of these 13 cases *massive subchondral bone and marrow necrosis* occurred in 12, and without question constitutes the outstanding feature of the femoral head pathology. *Granulation tissue*, present in all 13 specimens, must also be considered an essential part of the microscopic disease picture. The type of *cellular infiltration* is less uniform. *Giant cells* were mentioned as occurring in 9 specimens; *leucocytes, eosinophiles and plasma cells* were present in 5 of the group. The condition of the *epichyseal line* was described in 10 of the 13 pases. In 4 of them it was completely destroyed. In 3 the line was interrupted, while in the other 3 it was entirely intact. The *surface cartilage* was normal in 12 of the 13 cases. (The necrosis of this tissue in the thirteenth case, that of Walter, can be readily accounted for as the result of a severe hip-joint arthritis before the occurrence of Perthes' disease.)

Comparing the findings in our case with

those of all 13 cases, (as grouped in the above summary), it is apparent that our specimen represents an early and typical example of the disease picture. For this reason, it may well be used as a criterion in evaluating the applicability of the more likely theories of pathogenesis.

Primarily, the most casual examination discloses that the gross femoral head deformity is secondary to collapse of the underlying necrotic bone. Consequently, it is the cause of this necrosis that constitutes the cause of the disease. While as a result of study of other specimens most observers have arrived at a similar conclusion, current literature still contains reference to such diseases as rickets and arthritis deformans as plausible causes of the disease. Massive bone necrosis is not observed in the pathological picture of these diseases and they can be excluded with certainty.

On the other hand, local bone infection, or osteomyelitis, cannot be so easily dismissed. In fact, it is conceivable that some such bone process has produced this condition. Massive bone necroses with little or no surrounding cellular or tissue reaction have been observed, presumably as the end-result of long standing infectious processes, in aged people. However, in the above case, the disease was not of long standing nor was the patient aged. In brief, if an organism can be of such avirulence as to produce an osteomyelitis without suppuration, without involucrum formation or sequestration, it is an infective agent with which we have had no experience. There is nowhere in this specimen any tissue suspicious of tuberculosis or lues and it is safe to say that these diseases have played no part in the pathogenesis of this picture. Furthermore, despite painstaking examination of numerous sections of the femoral head and round ligament stained for bacteria (including spirochetes) no such organisms were discovered.

Thus, while bone infection cannot be definitely excluded as the basis of the necrosis in the examined specimen, there are many characteristics which suggest that vascular occlusion in the more likely origin. The intact cartilage, the complete absence of any remnant of vascular system in the necrotic tissue, and the mild type of peri-necrotic reaction simulate closely what would be expected as a result of aseptic infarction in this area.

Attention is thus directed to the vessels which, by their occlusion, might produce femoral head infarction. There are two such groups of vessels:

1. The lateral epiphyseal vessels.
2. The round ligament vessels.

The experiments of Bergmann have demonstrated that a focus of necrosis in the upper femoral epiphysis follows occlusion of the lateral epiphyseal branches in rabbits. Similarly, recent experiments of Zemansky and the author have shown that, in young rabbits, a condition closely simulating Legg-Perthes' disease can be produced by interference with the round ligament blood supply. Occlusion of the round ligament vessels was suggested as early as 1914 by Schwartz as the cause of the deformity in Perthes' disease. At that time, the importance of these vessels to the adolescent femoral head was much disputed and consequently Schwartz's suggestion received little support. A thorough consideration of the merits of Schwartz's theory in the light of more recent investigation is beyond the scope of this paper. It is, however, in this connection that the charges observed in the round ligament of our specimen are especially interesting.

The chief finding, vascular obliteration, appears to some extent to be a normal occurrence in children of this age. I have examined round ligaments removed at autopsy from 2 children of approximately the same age in which the femora were normally developed. Vascular thickening was present in these specimens but was much less marked than in the Perthes' disease specimen. No arteries were completely obliterated and, of course, there were no inflammatory changes. The study of more normal ligaments is necessary

before the vessel obliteration in this case can definitely be termed pathological.

The perivascular infiltration, hemorrhage and edema in the round ligament may be interpreted in several ways. It is possible that these phenomena are closely associated and that they result from vascular occlusion in or proximal to the ligament. It is also conceivable that the perivascular infiltration is directly due to the inflammatory process which has caused the vessel obliteration thus leading us to the source of Legg-Perthes' disease. Again, one cannot neglect the possibility that all of these changes represent nothing more than the result of irritation due to altered joint mechanics plus operative trauma.

In the present state of our knowledge it is futile to speculate further regarding the causes and relationship of these phenomena. Pathological studies of other specimens are under way and the normal characteristics of the ligamentum teres in the adolescent are being studied. It is hoped that these efforts will lead to a clearer conception of the above findings and of the pathogenesis of the disease.

In conclusion, I wish to express my thanks to Dr. Royal Whitman for permission to report this case, to Dr. Samuel Kleinberg for referring the specimen to me, and to Dr. Paul Klemperer for his valuable assistance in reviewing the material.

SUMMARY

1. The femoral head and ligamentum teres removed from a case of Perthes' disease are described.

2. The applicability of the more probable theories of pathogenesis is discussed.

3. The theory of vascular occlusion is adopted as the most fitting explanation of the pathologic findings.

4. The plausibility of the theory of occlusion of the ligamentum teres arteries is discussed in the light of the findings in the presented case.

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FURTHER OBSERVATIONS ON THE OPERATIVE TREATMENT OF LEGG-PERTHES' DISEASE*

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THE operative treatment of Legg-Perthes' disease is based on the observation that irregularities of the articulating surfaces of the hip joint in childhood, of whatever nature, are important predisposing causes of arthritis deformans and progressive disability in later life.

Legg-Perthes' disease is apparently a primary necrosis of the head of the femur induced by defective blood supply. This is followed by a process of disintegration of the dead bone, its replacement by fibroid tissue and accompanying collapse of structure and deformity. The duration of the symptoms and the final effects are

determined by the area of necrosis, the character of the regenerative process and the secondary involvement of the joint. In the majority of cases, particularly those in childhood, according to the reports, the disability is slight, and practically complete functional recovery may be predicted within a comparatively short period.

There is however a group of cases estimated as about 20 per cent of the entire number in which disability may persist indefinitely and in which the disorganization of the joint is progressive. It is in this class that operative treatment may be indicated to relieve the immediate symptoms and to prevent future disability.

Three cases of this type, operated on recently, form the basis of this paper. All were in well developed adolescents so that loss of growth need not be considered, and in all the intervention was indicated by the character of the symptoms and the degree of deformity. Two of the cases have been described already[1] and they will be but briefly sketched.

The first patient was a boy sixteen years of age. The duration of the symptoms, essentially stiffness and discomfort in the right limb and limp, was between one and two years and the deformity of the head had increased in spite of the protection of a plaster spica. The second patient was a corpulent girl twelve years of age. She was brought to the hospital for persistent limp and restricted motion in the left hip joint. The onset of the symptoms had been apparently sudden, as she had remained in bed for several weeks for the treatment of rheumatism. The third case, a well developed boy, had been under observation at another hospital for two years. Originally a diagnosis of displaced epiphysis had been made, and an apparent reduction had been accomplished, but the symptoms of stiffness and discomfort persisted and the roentgenogram showed characteristic and progressive deformity.

The reconstruction operation, which was performed in these cases, is in substance

the removal of the deformed head fashioning the extremity of the neck to a smooth, rounded extremity and transplanting the trochanter to the outer side of the shaft, thus by extending the area of the neck and restoring the leverage for the abductor muscles, reconstructing as far as possible the normal mechanical relations of the joint, hence the name.

From the mechanical standpoint the operation might be compared to an arthroplasty of the most favorable type. Thus improved function seemed fairly assured and there was the further incentive that direct investigation of the condition of the joint might demonstrate the true nature of the process.

In the first case the articular cartilage, in adaptation to the internal collapse, had been thrown into crumpled folds, but there was no evidence of arthritis. In the second case the ligamentum teres was dark red in color and congested, as were the tissues in the cotyloid notch, a condition that might explain the sudden onset of the symptoms. In the third case there was evidence of what might be interpreted as a mechanical arthritis, points of erosion of the cartilage both of the head of the femur and of the acetabulum and a growth of fibrous tissue on the cartilage, changes that might be explained possibly by the injury at forcible reduction of the displaced head, while the subsequent deformity might be accounted for by the incongruity of the articulation and by defective nutrition.

Thus it will appear that from the operative standpoint the characteristic feature of Legg-Perthes' disease is the deformity and these cases would seem to indicate that a variety of conditions may be included under this title.

The study of the specimens obtained at operation was undertaken by the late Dr. Zemansky,[1] and since his untimely death the work has been carried on by Dr. Lippman.[2]

[1] Am. J. Surg., 4:169, 1928; 5:385, 1928.

[1] ZEMANSKY, A. P., Jr. Pathology and pathogenesis, of Legg-Calvé-Perthes' disease. Am. J. Surg. N. S., 4:169, 1928.
[2] LIPPMANN, R. K. See p. 785.

LEGG-PERTHES' DISEASE WITH SPECIAL REFERENCE TO PROGNOSIS & TREATMENT*

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THE course of disease in the mushroom type of coxa plana is distinctly different from that in the cap type. The mushroom type does not show so much atrophy, nor does it fragment as often as the cap type. The migration of this type toward the trochanter is rarely as much as the cap type, therefore, there is ultimately not so much limitation in abduction. The end-result in this type is reached considerably sooner than is the cap type.

The cap type of epiphyses practically always fragments, and migrates well out to the trochanter. After the fragmentation has taken place it begins to fill in with new corticle bone and ultimately becomes a solid epiphysis, but remains flattened. The course in this type may be four to five years.

FRACTURE OF THE NECK OF THE FEMUR IN CHILDREN†

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BEFORE the introduction of the roentgen ray this type of fracture was rarely recognized in children and most observers denied even the possibility of its occurrence. At present the condition is frequently overlooked until a fixed and disabling type of deformity has developed. While a fracture of the neck of the femur may occur at any age, the young and the old appear to be particularly susceptible. Recently the writer reported the cases that had occurred during the last ten years at Bellevue Hospital. During the past twelve months 6 additional cases have been observed at this hospital and at the Hospital for the Ruptured and Crippled, the majority of which have presented bony deformity resulting from no treatment or improper treatment. The percentage of untreated cases in children that develop non-union must be very small, so that this result may cause little anxiety. These untreated cases, however, will present a striking limp with the disability increasing as the child grows older. The roentgenograms will usually show, in these cases, a shortening of the neck of the femur, upward displacement of the trochanter, and bony union in this malposition. This gives a mechanically unstable joint which is easily subject to arthritic changes later in life.

* Read at Sixteenth Annual Meeting of the Alumni of the Hospital for Ruptured and Crippled, N. Y., Nov. 19-20, 1928. Slides were shown of a case of coxa plana following atraumatic dislocation of the hip, also a case that showed a clear-cut area of absorption in the neck with a flat epiphysis from which no growth could be obtained on any media from the contents of this area.

† From the Hospital for Ruptured and Crippled, First Division. Read before Surgical Section, New York Academy of Medicine, December 7, 1928; and Annual Meeting of the Alumni of the Hospital for Ruptured and Crippled, N. Y., Nov. 19-20, 1928.

Whitman must be considered as the exponent of a radical reform in the treatment of fracture of the neck of the femur.

FIG. 1. Roentgenograms taken one year after a child, aged ten years, had suffered a complete fracture of the neck of the femur. This patient was treated by the abduction method and shows complete obliteration of the line of fracture.

This method he described in 1897, having presented a case before the New York Academy of Medicine several years previously. Taylor in 1917 reported 6 cases that he had seen and he believed that the usual type in children was an incomplete or greenstick variety to which he gave the name "hinge fracture." The youngest case that could be found on reviewing the literature was that described by Greig, occurring in a child two years of age. This patient gave a history of having fallen on the hip while in the act of climbing, and a roentgenogram showed a fracture of the neck of the femur with upward displacement of the greater trochanter. Several French observers have recently stressed a fact brought out by Whitman many years ago, that epiphyseal fracture or separation

may be quite difficult to differentiate clinically from a fracture of the neck of the femur. Before the general use of the

FIG. 2. Roentgenogram of Case 1 shows an untreated fracture of the neck of the femur in a child, aged six years, illustrating the resulting deformity.

roentgenogram this mistake was frequently made. At present we feel that separation of the epiphysis alone, in very young children, is an atomical impossibility due to the thick plate of cartilage covering the whole upper end of the femur. A real displacement of the epiphysis occurs usually in the overgrown, obese, or flabby type of adolescent child.

In the type of fracture under discussion the patient almost always gives a history of severe violence, such as a fall or having been struck by an automobile. These children as well as adults usually present shortening, outward rotation of the limb and pain on motion. The fracture may be of the complete or incomplete variety but in children the latter type presents very little disability and in several of the cases seen the patients were able to walk about with slight discomfort complaining only of pain referred to the region of the knee joint. Taylor tersely remarks that "if all hip injuries were carefully examined and roentgenograms taken at once, the surgeon would often be spared the mortification of an erroneous diagnosis and many patients would be saved from serious and sometimes lifelong disability."

The somewhat unsatisfactory method of

dividing this type of fracture into intra- and extracapsular has not been employed with the 12 cases observed, but the classifi-

The Whitman method was first described over thirty years ago and it would be unnecessary to discuss the thoroughly

FIG. 3. Roentgenogram of Case III shows an old untreated fracture of the hip. The marked coxa vara with impingement of the greater trochanter against the ilium completely restricts abduction.

FIG. 4. Roentgenogram of Case IV shows a fracture that occurred in a child who had complete paralysis of both lower extremities.

cation of Delbet has been used. He divided them into (1) subcapital, (2) transcervical, (3) cervicotrochanteric, and (4) pertrochanteric. The majority were of the complete cervicotrochanteric type and in only 2 cases did the fracture occur through the narrowest portion of the neck, a type extremely rare in childhood.

Seven cases ranging from three to eleven years of age have been treated by the Whitman abduction method and the other 5 cases show the results of improper treatment. Of the 7 cases seen early and treated by the abduction method 1 is at present in a plaster spica, the other 6 present excellent function with bony union and none of these cases show more than ¼ in. shortening. In contradistinction to this the 5 cases receiving inadequate treatment have all developed coxa vara with marked shortening and limitation of motion.

accepted anatomical and mechanical basis for this procedure. However, it may be of interest to review briefly the essential features in the practical application of the Whitman abduction method, before adding the histories of some recently observed cases.

The patient is anesthetized on a fracture table and while the operator steadies the pelvis, downward manual traction is made on both limbs until the shortening is overcome and verified by measurement of the sound side. Then the limbs are simultaneously abducted and a comparison is made of the bony landmarks. The fractured limb, while under traction, is held in the attitude of maximum abduction, moderate hyperextension at the hip, inward rotation, and slight flexion at the knee, by means of a long plaster-of-Paris spica extending from the axilla to the toes. A point to be stressed is that often abduction is incompletely accomplished. The bony prominences should be well padded and it is more satisfactory to have trained assistants hold the limbs while the plaster is being applied than to use the foot pieces on the fracture table.

Elevation of the head of the bed will render these patients more comfortable and by having then turned over in bed once

FIG. 5. Roentgenogram of Case VI shows a fracture that occurred in a child, aged three years, who was first seen three months after the original fracture. Apparently there has been a refracture through the neck.

or twice daily the danger of pressure sores, and in older patients lung complications, may be avoided.

While individual factors must decide the length of time the fracture requires immobilization, usually this type of fracture in children should be in the abduction spica about three months, if the fracture is of the complete variety. With the incomplete or greenstick type the period of immobilization may be shortened. On removal of the plaster the patient should not be allowed to bear weight at once but gradually become accustomed to moving and exercising the limb in bed; and in some cases it may be advisable to use a hip splint for the interval between the removal of the plaster and the actual weight bearing. Too early weight bearing is a frequent cause for the deformity of coxa vara developing at the site of the softened callus.

SUMMARY

1. Fractures of the neck of the femur in children are frequently unrecognized until bony deformity has resulted.

2. The deformity resulting from inadequate treatment of this type of fracture causes marked disability.

3. Roentgenograms of all hip injuries should be insisted upon as early as possible.

4. Early application of the Whitman

FIG. 6. Roentgenogram shows Case VI after reduction by the Whitman abduction method, illustrating the perfect position attained by this method.

abduction method will assure for these patients a restoration of the form and function of the joint.

CASE REPORTS

CASE I. A girl, aged six years, walked into the clinic at Bellevue Hospital, complaining of occasional pain in the hip. She gave no definite history of any injury to the right hip but walked with a marked limp. Examination showed a slight flexion deformity at the hip with outward rotation of the leg and elevation of the greater trochanter. The limb was in an attitude of slight adduction and any attempt at abduction was restricted by bony deformity. Roentgenograms showed an old fracture of the neck of the femur with marked coxa vara.

CASE II. A boy, aged six years, was recently admitted to Bellevue Hospital and gave a history of having fallen out of the open door of a moving automobile three weeks previously. He was unable to walk and the left leg was rotated outward, with elevation of the greater trochanter. Roentgenogram showed a complete peritrochanteric type of fracture and an abduction plaster-of-Paris spica was applied under ether anesthesia. Patient is at present in the spica and a recent roentgenogram shows a satisfactory approximation of the fragments.

CASE III. A girl, aged sixteen years, came

to the Hospital for the Ruptured and Crippled, on account of pain and discomfort in the left hip whenever she walked a short distance. Pain was much worse in damp weather. The girl gave a history of having fallen and injured the hip at two years of age, but received no hospital treatment at that time. Roentgenogram at present shows a marked coxa vara with the deformed head in the acetabulum and a line representing the old fracture, of the complete cervicotrochanteric variety. The greater trochanter is elevated and resting against the dorsum of the ilium, thereby limiting abduction.

CASE IV. A boy, aged ten years, in an attempt to get out of bed fell and injured the right hip. This child for several years had walked with crutches and wore double upright braces on account of an attack of infantile paralysis. A roentgenogram, made at the time of the accident, showed a complete trans-cervical fracture and the child received inadequate treatment. A roentgenogram taken a few years later shows absorption of the head and neck with marked shortening. The patient is still able to walk with the aid of crutches and braces, and refuses treatment.

CASE V. A girl, aged ten years, walked into the clinic at the Hospital for the Ruptured and Crippled. She was wearing a high shoe on the right foot and the principal complaint was difficulty in walking. No definite history of injury could be obtained, but the roentgenogram showed a marked coxa vara deformity with a line of fracture through what apparently was the original neck of the femur.

CASE VI. A girl, aged three years, fell from a fourth story window three months before admission to the Hospital for the Ruptured and Crippled. This child had been treated in another hospital with inadequate plaster support. She walked with a limp and presented limitation on motion, outward rotation of the leg, elevation of the trochanter and about $\frac{3}{4}$ in. shortening. A roentgenogram showed a fracture through the neck of the femur with a marked degree of coxa vara. In view of the age of this patient it was felt that attempts should be made at closed reduction, and under ether anesthesia the shortening was overcome and the hip stretched into an attitude of full abduction and inward rotation. A Whitman abduction plaster spica was applied. Patient wore this for two and one half months and at present there is $\frac{1}{4}$ in. shortening but satisfactory range of movement at the hip. While the complete reduction of the fracture was obtained, this case illustrates the danger of too early weight bearing; and the last roentgenogram shows that coxa vara has developed.

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USE OF THE ABDUCTION METHOD IN THE TREATMENT OF RECENT FRACTURES OF THE NECK OF THE FEMUR*

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AT the outset, I wish to state that this paper will consider the treatment of recent fractures, and by this I mean fractures that have taken place in the neck of the femur within two or three days. I feel strongly that this, the Whitman abduction method, has its greatest field of applicability during this period, and that one of the errors which has subjected the method to criticism has been its application at a much later period when changes between the fractured surfaces leading to non-union have already been instituted. My remarks, therefore, will apply only to cases that have been seen within two or three days, and when the condition of the patient has warranted the application of what we consider proper treatment.

I shall not enter into details on the technique of this method, which is well known. One would feel that the technique should therefore be carried out to the last letter, but I doubt that Whitman's teachings are carried out properly in all cases. Hence the results of such treatment may be subjected to criticism founded on end-results, often including cases subjected to improper technical treatment. It is, of course, unfortunate that such conditions exist even in our best institutions, and under men who have apparently been trained along orthopedic lines. Surgery in general, however, is probably subjected to this same danger in many other branches, so that we can only call attention to these errors, and urge trained men to follow out lines of treatment that have been thoroughly established and proved to be of value, and encourage them to make no change in recognized methods until experience and age have really brought to them a better sense of judgment than most of us have during our earlier years.

One of the frequent questions asked in the treatment of elderly people by this method is the danger of anesthesia. We have practiced in New England in a large number of hospitals, and have taught this method to good men, and have been most gratified to find that it has been carried out as we taught it according to the original technique of Dr. Whitman. We have had no cases of pneumonia following etherization, a fact which we attribute largely to scrupulous immediate after-care in keeping patients constantly turned from one side to the other, allowing them out of bed at an early period, often as soon as the third day, and keeping them active, no matter how old, to prevent hypostatic congestion. In a number of elderly people we have adopted the use of large doses of morphine to narcotize the patient to the degree where this method could be practiced. Of late we have been quite impressed with the value and field of spinal anesthesia, which we have used in several cases with great success, and probably lessened danger. I merely call attention to this, not that it should be used as a routine, but that in properly selected cases it may be of considerable value. Here again, it should be properly given, supervised by men who understand its use and its dangers.

As to operative treatment in these recent fractures, we have never once practiced it, and feel very strongly that

open operative interference can be applied only to the field of non-union. And here, there are various methods that have been tried by skilled operators, and I believe the selection of the method depends largely upon one's judgment and familiarity with any of the two or three recognized methods of treatment of non-union of the fracture of the neck of the femur. We in Boston have found that the reconstruction method as outlined by Whitman can be done in a short space of time, and the functional results are satisfactory. The selection of one method,

gaining familiarity and perfection of technique, I believe is of the utmost importance.

I have been asked especially to say something of our results. Here again, I want to state that these results apply to the recent cases, that is, those seen and treated within the first few days. The percentage of union in these cases has been extremely high, and satisfactory function has been obtained with the use of this method. So far as we are concerned, we have advised its use not only in Boston but throughout the larger centers of New England.

THE TREATMENT OF FRACTURE OF THE NECK OF THE FEMUR*

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IN 1903 Bissell[1] proposed immediate operation for fracture of the neck of the femur on the ground that mechanical treatment as demonstrated in three of the leading hospitals of New York was futile. This conclusion had been confirmed during the present year by Katzenstein[2] who presented to the Surgical Society of Berlin a report of 169 cases of transcervical fracture, to which this discussion is limited, treated by conventional methods. The death rate was nearly 18 per cent and in but 11.5 per cent were the results classed as good. Löfberg,[3] on the other hand, in a similar number of fractures of the same type treated by the abduction method secured bony union in 67.5 per cent of the cases with a death rate of but 6 per cent.

Although these results were less favorable than those reported by Anschütz and

Campbell of nearly 90 per cent of bony union, they might be accepted as fairly representative of unselected cases in hospital practice.

The immediate operation, as far as represented in the literature, has been restricted to cases of a favorable type and undertaken, it might be assumed, only by surgeons of exceptional skill and experience. The results therefore could be compared fairly only with a similar group in which the abduction treatment had been applied with equal efficiency.

In the treatment of other fractures operative intervention is indicated only when deformity cannot be corrected or apposition assured otherwise. These essentials, as far as might be determined by the tests considered conclusive for other fractures, might be more uniformly attained at the hip joint than in any other region of the body.

It is generally conceded that in a certain proportion of the cases, notably of the

[1] Bissell, J. B. Phila. M. J., 11: 900, 1903.
[2] Katzenstein. Zentralbl. f. Chir., Feb. 27, 1928.
[3] Löfberg, Zentralbl. f. Chir., 54: 2222, 1927.

* A contribution to the discussion on the indications for primary pegging of the fragments. Read at Sixteenth Annual Meeting of Alumni of Hospital for Ruptured & Crippled, N. Y., Nov. 19-20, 1928.

subcapital type, there is an actual incapacity for repair and this factor together with the operative risk must be considered in the comparison.

The question for discussion therefore is whether the proportion of failure could be sufficiently reduced and functional results sufficiently improved to justify the hazzard of an open operation without testing conservative treatment.

The typical operation is the introduction of an intermedullary splint; and whether of autogenous bone as advocated by Albee, of beef bone as used by Hey Groves or of metal as demonstrated by Smith-Peterson, all shared the disadvantage of injury to the cancellous structure of the neck from which repair proceeded.

It has been claimed as an advantage of these operations that external splinting was either unnecessary or might be discontinued within a short period to permit exercise which might stimulate repair. This is a proposition of doubtful utility because the leverage of the limb must place a dangerous strain upon a frail and precarious support. Furthermore, in this fracture as contrasted with all others there was no formation of external callus and since the nutrition of the head fragment was often defective the reparative process was analogous to that of bone grafting, the first essential being secure fixation of the fragments for a relatively long period.

Granting that by direct inspection a more accurate adjustment of the fragments might be attained, the conservative method has the advantage that it entails no injury to the overlying parts and that the process of repair is not retarded by the space left by the removal of the metal splint nor by the nutritive changes incidental to the absorption of a foreign substance within the joint.

For one who for many years has been attempting to establish a comprehensive treatment for fracture of the neck of the femur in accord with surgical principles, the results of the Smith-Peterson operation are of particular interest because as contrasted with autogenous bone pegging they demonstrate the inherent capacity for repair if apposition of the fragments is maintained. If therefore it is conceded that a restricted class of patients is entitled to such highly specialized and expert service, it follows logically that the others comprising the great majority of the cases are entitled to an equally efficient conservative treatment.

Such a standard can be enforced only by holding the surgeon responsible for the primary essentials of functional repair, now attainable and physically demonstrable in practically all cases. In other words, since it has been proved by ample experience that fracture of the neck of the femur is now amenable to the rules that govern the treatment of other fractures it should share with them whatever protection from incompetence the liability to legal reprisal may assure.

The abduction treatment is a definite surgical procedure, of which the effects both on life and limb are determined in great degree by the skill and experience of those who apply it. At the present time it is not generally admitted that the most disabling of all fractures is entitled to expert care, and lack of training, particularly in plaster splinting, may best explain the modifications of the method that have been introduced as well as much of the adverse criticism to which it has been subjected.

A PLASTIC OPERATION FOR UNUNITED FRACTURE OF THE HIP*

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I WOULD like to preface these remarks by saying that the procedure I will now introduce is not wholly new, but based on the principles of the reconstruction operation of Whitman and the Murphy operation for ununited fracture of the neck of the femur. It is based on the assumption that the fractured head is viable and that by proper application to the reconstructed neck there will be firm union. The advantage of this procedure is that a normal joint is obtained and in addition to a painless stable hip there is a considerable amount of motion. The 2 cases done by this method by Dr. Nicola and myself have been exceedingly satisfactory and warrant a continuation of the procedure until we have a large series from which we can draw definite conclusions.

The usual semicircular incision extending downward from the anterior superior spine and across the thigh below the region of the trochanter is made. The trochanter is reflected with its muscle and the shaft of the femur dislodged. The neck is rounded and shaped in the usual manner; the head of the femur is removed completely from the acetabulum and reamed out sufficiently to assume a cup shape and fit securely over the rounded head of the femur. The cup-shaped head is held in place by a small bone nail. The reconstructed femur is then placed within the acetabulum and the trochanter displaced downward and fixed. The wound is then closed and the leg is placed in a fair degree of abduction and a plaster-of-Paris spica applied. The plaster is left on six weeks and walking is begun upon its removal. It is surprising the amount of motion and function that quickly returns. Neither of these 2 cases have had physical therapy.

RIB GRAFTING FOR SCOLIOSIS*

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NEW YORK

BEFORE describing the details of the operation of rib resection and rib grafting supplemental to spine fusion, a summary of its development might make its scope and indications more clear.

Nine years ago a patient came under my care, suffering from progressive scoliosis of the most severe type, with an extreme razor-back deformity. He could not for a moment discard apparatus without the development of constitutional symptoms and still further collapse of his spine. He had worn apparatus of all types: braces, corsets and plaster jackets. In spite of all precautions he repeatedly developed a pressure sore over the point of greatest convexity of the ribs. At such times he was forced to enter the hospital and lie in bed to permit healing of the ulcerated area. As time progressed this healing became more slow due to constantly lowered tissue vitality. Finally the ulcer was excised. The

sutured wound left after the excision healed by first intention and the skin over the prominent ribs appeared normal, but on application of a most carefully padded, personally applied plaster jacket the same area promptly broke down.

It thus became evident that the underlying cause, the sharply protruding ribs, must be removed in order to cure these secondary effects. Sections of three ribs, representing their most prominent convexity, were therefore subperiosteally removed. Their arrangement bore no relation to the normal. Their direction was practically vertical, and they overlapped each other like the shingles on a roof, so that after removal of a section of the most superficial another rib was found directly below it. It was only after sections of three ribs had been removed that the pleura was encountered. About 4 in. of the most superficial rib were resected, three of the second and two of the third; in each case as much as their deformed structure permitted. The wound was closed in the usual manner and the patient placed upon a convex stretcher frame on which he remained during the period of regeneration of the resected areas of the ribs, a period of about six weeks. It was thus made impossible for that particular deformity to recur. His convalescence was entirely uneventful, the wound healed by first intention, and there was a considerable improvement in the appearance of the patient's trunk. He resumed wearing plaster jackets and since that time has had no recurrence of his pressure sore.

As time wore on it became evident that not only that particular patient but several others were condemned to wear apparatus that to be effective must be cumbersome, uncomfortable and unwieldy, and that, if the reverse, would be ineffective. The progression of the deformity which would follow removal of apparatus would cause grave constitutional symptoms, in which case the prognosis as regarded life was bad.

Under such painful circumstances one was forced to consider operative treatment, although the patients represented the most unfavorable possible class of cases for operation. The risks of such a procedure were carefully explained to parents and patients both, and in all cases they preferred any risk rather than the certainty of an harnessed lifetime.

At this point the second step of the operation presents itself. I have observed in operating upon the more advanced types of scoliosis, that at the point of maximum curvature the laminae on the convex side of the vertebrae were so overhung by the deformed spinous processes and ribs as to be in many cases inaccessible. The efficacy of the routine Hibbs operation was thus in these most severe cases diminished one third. It therefore occurred to me that this defect might be remedied by the use of a bone graft, and that for that purpose the excised sections of ribs were practically ideal. Their curvature, by some fortunate natural coincidence, almost exactly fitted the convexity of the spine.

The usual Hibbs operation, therefore, was carried out as far as the deformity in a given case permitted. The excised sections of ribs were then laid in the bed prepared for them on the concave side of the curvature, and the spinous processes split longitudinally and vertically to overlap the ribs and interdigitate with each other. The ribs were sometimes removed at the same operative session as the spine fusion, or at a previous operation, when they were preserved in alcohol, then boiled and used as dead grafts. This was determined by the condition of the patient. The ribs were sometimes split and sometimes used whole. Irrespective of their being split or unsplit, fresh or boiled, homologous or heterogeneous, in all cases the wounds had healed by first intention, none of the grafts or portions thereof had extruded, and in all cases they appeared roentgenologically to have been rapidly replaced by an unusually heavy deposit of bone.

After operation the patients were placed in a previously prepared posterior plaster

shell in which they lay for eight weeks. A plaster jacket was then applied which in turn eight weeks later was replaced by a brace. The cases of idiopathic scoliosis had discarded their apparatus entirely. The paralytic cases wore only apparatus, usually a duralumin Knight spinal brace, to support the unoperated portion of the spine. All the patients showed marked constitutional improvement, and were pleased with the result of the operation. In the series of 15 cases extending over five years there has been no mortality.

I wish to emphasize in closing that the operation was offered as a contribution in an extremely limited field, and that in contrast to other operations for scoliosis it was performed for, and its results determined by, the general constitutional condition of the patient.
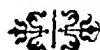
BEEF BONE GRAFTING FOR SCOLIOSIS*

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NEW YORK

SINCE the purpose of a fusion operation in scoliosis is to secure fixation of the spine and thereby arrest the deformity, I have introduced a beef bone graft on the concave side of the curve to assure bony fusion and solidity of the operated area.

My earliest spine fusions were performed on cases of moderate and severe scoliosis. In many of these the laminae and transverse processes were so markedly distorted that it was very difficult, and in some cases impossible, thoroughly to bare the posterior arches. Consequently the fusion of the vertebrae was not so complete as was desirable. In addition I found that while it was possible to reduce rapidly the curvature of the spine by weight traction on a convex frame, there was a strong tendency to immediate relapse when the traction was released. We had, therefore, two major obstacles to a satisfactory result. It occurred to me that these factors might be controlled by using a bone graft to supplement the fusion operation.

The graft, which is of beef bone, is usually about ⅜ in. in thickness and long enough to extend from one end of the main curve to the other. It is laid upon the laminae of the vertebrae on the concave side of the curve, and is fixed to the spinous processes of the vertebrae at both ends of the curve. Numerous cuts are made into the graft to facilitate vascularization. The fragments of the split spinous processes are distributed over and alongside of the graft to favor extensive new bone formation. The curve of the graft is decidedly less than that of the spine so that, when the graft is fixed in place, it prevents relapse of the curve to the preoperative state.

The advantages of the use of a beef-bone graft in a spine fusion for scoliosis are the following: The graft stimulates new bone formation; the graft maintains the preoperative reduction of the curve while the vertebrae are becoming fused because it is fixed at the ends of the curve; the graft is a scaffold for the deposition of a long and wide sheet of bone; the graft is particularly valuable in the severe cases in which it is impractical or impossible to do a thorough Hibbs fusion operation.

Beef bone is preferred to an autogenous graft because it may be prepared before the operation and has the required strength, length and thickness. In addition, the patient is spared an operation on the leg

with its attendant trauma and inconvenience, and the total time of operation is at least twenty minutes less than it would be were an autogenous graft employed. The graft becomes fragmented in about six to seven months and gradually disappears in the course of several years. In the majority of the cases the graft is invisible two years after the operation. In several instances parts of the graft have remained unabsorbed as long as four and a half years.

I have used beef bone in 54 spine fusions for scoliosis. While at first I operated only on patients with severe deformities, I have in the last few years used the beefbone graft in fusing the mild cases in the belief that, if the graft is beneficial in the severe types, it will be of even greater prophylactic value in the milder forms. Of the 54 cases, 40 were idiopathic scolioses, 8 paralytic, 4 rachitic and 2 congenital. The ages of the patients ranged from nine to thirty-five years, but the majority were in the adolescent age period. Of the 54 cases 34 were re-examined recently. The time since the operation varied from one and a half to seven and a half years. In 27 the result was excellent, in 5 the result was good and in 2 cases there were failures. From this analysis I am encouraged to continue to use beef-bone grafts in the fusion operation for scoliosis, and believe that the addition of the graft aids materially in the ultimate stabilization of the spine.

THE TREATMENT OF FIXED OBLIQUITY OF THE PELVIS*

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BY fixed obliquity of the pelvis is meant tilting of the pelvis due to a contracture of muscle groups resulting in an inequality of the length of the legs. The contracture is of such a nature that if the actual length of the legs is equal, the tilting of the pelvis prevents the patient from bringing the heel of the short leg against the heel of the long leg. If the pelvis is brought into a horizontal plane one leg will be abducted, the other adducted.

This pelvic obliquity may be divided into different types depending upon the muscle groups involved. In the simplest form it is due to a unilateral contracture of the abductor muscles. Secondarily there is a shrinkage of the fascia and in the severe cases also of the capsule of the joint. The second type is caused by a contracture of the abductors of one side and of the adductors of the opposite side. In the third type the situation is complicated by contracture of the spinal muscles producing a fixed deformity of the lumbar spine.

The methods of correction vary depending upon the type and the length of time during which the deformity has been present. In comparatively recent cases (those of a year or less) it is frequently possible to correct the pelvic obliquity without operative intervention. Traction is applied directly to the elevated side of the pelvis by means of a leather pad which fits the crest of the ilium accurately. The abducted leg is gradually brought into an adducted position and the patient is taught to press against a block at the foot of the bed so as to push this side of the pelvis up. The adducted leg has traction applied to it and is gradually brought into an abducted position.

In the cases of longer standing, operative measures are necessary. In the first type where the contracture is unilateral, the operation consists in a complete division of all the tightened structures, namely, the fascialata, the abducting muscles and the capsule of the joint. This is best done by a long lateral incision; the tip of the trochanter with the abducting muscles attached to it is cut off with a chisel thus exposing the capsule of the joint. To maintain the leg in the adducted position the incision is prolonged down to the knee and a strip of fascia measuring 1 or 2 in. in width is dissected upward to a point about midway between knee and hip. The lower end of the fascial strip is brought across the thigh subcutaneously and is fastened under tension to the pubic spine in the region of Gimbernat's ligament.

In the second type, where in addition to the contracture of the abductors there is a contracture of the adductors of the opposite side, the first operation must be supplemented by a second operation in which the adductors are freely divided.

In the third type, after the first two procedures, traction must be applied to the spine so as to overcome the deformity due to the spinal muscles, and when the maximum of improvement has been gained, the lumbar spine should be fused by one of the methods now available. I have myself had recourse to a new type of bone graft running from the crest of the ilium about 2½ in. from the mid-line upward to the spine of the first lumbar vertebra, thus giving the lumbar spine an oblique support corresponding to the flying buttress of a cathedral. In addition a straight graft is placed between the split spinous processes by the Albee method.

SUPPURATIVE ARTHRITIS OF THE KNEE JOINT

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HERETOFORE the established procedure, more or less universally practiced, in the treatment of infected joints, however slight or severe, has been immediate immobilization of the infected joint or joints by means of splints, extensions, casts etc. If surgical intervention was necessary, incisions and counter incisions, all types of drainage tubes and various irrigations failed of their objective, due to their inability to evacuate the pus and eliminate the progress of the infection. In many cases resection or amputation followed.

The disadvantages of this method on the infected joints and the surrounding soft tissues were readily recognized, such as partial or complete ankylosis, atrophy of the muscles, destruction, contractions, and adhesions of the capsule. The treatment by immobilization had apparently been instituted for the relief of pain without considering the after effects on the infected joint. Many of these joints failed to yield either partially or completely to the usual physiotherapeutic measures. This, no doubt, was due to the lack of a more suitable treatment.

Before the War, Willems of Belgium treated simple industrial joint injuries by means of aspiration and found that immediately upon the relief of pressure these patients had free use of their joints without pain. This pain and loss of motion was due

to distention of the capsule with fluid. Usually, one aspiration of the joint was sufficient to enable the patient to return to work within three or four days without a recurrence of symptoms. During the World War he successfully used this treatment on penetrating wounds of the knee joint in which there was no osseous destruction. Later it was used with good results on knee and elbow joints having secondary infections.

The treatment of infected joints by the method I am about to describe may be summed up in one outstanding statement as *arthrotomy with immediate active mobilization of the joint*. This is directly opposite to our former method of treatment by immobilization. The technique we use consists of a diagnosis accomplished first, by a consideration of the history of the case generally, and second, by aspiration of the joint locally, to determine the type of infection present.

Tuberculosis of the joint is the infection to which this method of treatment is not applicable.

The diagnosis established, the following treatment is begun: First, we will discuss the knee joint. A 2 to 3 in. linear incision is made about ½ in. from the patella on the inner or outer side and extending from the upper to the lower pole. A dissection is made down to the capsule which at this point is very superficial and a similar incision is made in the capsule. If the cut edges of the capsule are now grasped with the tissue forceps and the patella lifted, the rôle which the synovial surfaces play in squeezing the pus toward the wound can be readily observed by flexion and extension of the knee. We then see the two synovial surfaces come in contact and sliding one on the other, squeezing the pus toward the wound, whence it dribbles out if scanty or escapes in jets if considerable. If these movements are repeated frequently and are of sufficient extent, pus is expelled as soon as formed and there is ideal drainage without drainage tubes. It is then seen that flexion empties the

lateral and the tricipital cul-de-sac while extension cleans out the inner osseous joint line in particular. This occurs, especially, at the point of maximum flexion and extension.

Following the opening of the capsule a small piece of rubber tissue is sutured to the capsule at the lower end of the incision to prevent closure and insure proper and consistent drainage. Care must be taken to prevent the rubber tissue extending beneath the capsule into the joint as this predisposes toward reinfection. A gauze dressing is then applied loosely to the incision to permit free drainage and unrestricted movement of the joint.

The same procedure applies in the treatment of the hip, elbow and shoulder. In the wrist and ankle joints incisions are made on both sides. The incision for the hip is made just external to the sartorious muscle. The shoulder joint is opened just opposite the anterior border of the deltoid muscle.

We shall now see that the operation is only a preliminary measure, in comparison with the real treatment of mobilization of the joint.

Mobilization should be started immediately after the patient recovers from the anesthetic and should be active. This is important, as it insures a greater degree of mobility in flexion and extension than if a longer period of time were allowed to elapse before motion is started. This treatment calls for an effort which the patient will make with the necessary perseverance only if he is constantly urged thereto. In this manner alone will we prevent muscular atrophy and retention of pus in the joint. One of the essentials in the successful treatment of the patient consists in acquiring his full cooperation by gaining his confidence. Having had before operation a very painful joint which he had carefully kept immobilized on account of increased severity of pain, he is now fearful at attempting any movement of the joint. It is, therefore, necessary to assure him that it will not be painful, but there will

be a slight stiffness on motion caused by the former immobilization.

The surgeon or trained assistant requests the patient to raise his entire leg to a right angle with his body, with the knee extended, lending him assistance if necessary. The patient then locks his hands around the thigh, the surgeon grasps the lower leg above the ankle and the patient is encouraged to flex the knee slowly, first being assured that the knee will not be allowed to bend suddenly. Following this, the patient will usually relax, permitting the knee to bend slightly, as sort of a test of your veracity. When he finds he is having no pain he will bend it still farther on until his fears become greater than your assurance. At this point, request him to extend the leg by his own muscle power. This will be quite an effort, due to atrophy, caused by more or less prolonged disuse of the quadriceps muscles. On second trial, he is very anxious to bend the knee farther. On the third or fourth attempt following at two-hour intervals (which has been our practice), the patient can usually flex the leg at least to a right angle with increasing motion each time thereafter, until he flexes and extends it normally without pain.

In cases of infection of the hip joint we have found that for complete expression of the pus the hip joint must be flexed to at least 10° or 15° more than a right angle. The same procedure applies to the elbow, shoulder and wrist joints. The incision is kept open until the discharge becomes serous in nature, and all thickening of the synovial lining has disappeared. This may take from ten days to ten weeks.

In our list of about 54 cases we have had 14 streptococci, 14 staphylococci, 1 diphtheria injection, 4 gonococci and 16 no growth. The majority of the 16 no growth cases were gonorrhea. Treatment: average, twenty-six days; shortest, ten days; longest, fifty-eight days. Duration of illness before operation: Shortest, one day; average, eight weeks; longest, two years. One failure; one death.

THE PRESENT STATUS OF SYNOVECTOMY*

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HARTFORD, CONN.

IN attempting to present the present status of synovectomy I must, in the first place, qualify my remarks by asserting that my experience with the operation and my knowledge concerning it are confined to its use in chronic infectious arthritis, except for a few digressions to be considered later. As I see it, the chronic arthritides are best classified as hypertrophic, atrophic and chronic infectious arthritis. I believe that these three classes are definitely differentiated from each other; that they can be separated and properly grouped by adequate study of the individual cases, aided by the application of certain well defined guiding principles and characteristics. Furthermore, I do not see any logic in applying the operation of synovectomy to any type of arthritis other than the chronic infectious type. If the principles of the differentiation of these three types are correct, then it follows that hypertrophic arthritis is primarily a disease involving the bone ends, and infectious arthritis is a disease primarily affecting the synovial membrane. Since the operation is intended to influence the synovial disease in joints where this

tissue is primarily involved, it seems illogical to attempt to apply it to any other type of arthritis and, so far as I am concerned, I cannot speak with any knowledge of the effect of such an operation upon any other type than that for which it originally was designed, with the exception as mentioned above.

The purpose of this operation is to remove the diseased synovial tissue where there has failed to occur a fairly prompt and complete resolution of the inflammatory exudate following an attack of chronic infectious arthritis. The basis for this declaration lies in the assumption that in the usual course of events, in this disease, there should occur a period of acute or subacute inflammatory reaction followed by the gradual absorption of the products of this process and the slow restitution of the functional integrity of the synovial membrane. Whenever such a resolution does not occur there remains a joint with a thickened synovial membrane containing a considerable amount of fibrous tissue which manifests itself by continued pain, limited motion, effusion and usually coarse crepitation on motion. It is to be assumed that such treatment as the elimination of focal infections, stimulation of the patient's resistance by vaccine therapy (by repeated injections or a specific vaccine or a few injections of a nonspecific vaccine) or providing a protein shock, accompanied by general constitutional hygienic measures intended to promote abundant eliminations and further calculated to relieve the patient of the burdens of worry, faulty nutrition, over-exertion, etc. will, as a rule, assist in the processes of resolution. In those instances, however, in which such measures are unsuccessful or in instances in which such measures have not been undertaken and the resolution of the exudate does not take place, it is the purpose of the synovectomy to achieve this object by the manual removal of the damaged synovial tissues. It is to be hoped that this procedure will be undertaken at a sufficiently early period to prevent the development of extensive fibrosis of the joint capsule and ulceration and absorption of the articular cartilages which seem to result from too prolonged retention of an extensive inflammatory exudate. The question of the exact period in the arthritic process when it is safe or desirable to do a synovectomy must be decided by individual judgment in each instance. In general there is no object in the procedure if resolution is proceeding properly but there is no reason for not doing the operation at any stage of a monarticular or polyarticular process if it is apparent that the synovial inflammation is so extensive that irreparable damage is bound to occur. In addition there are some grounds for supposing that the early exhibition of this procedure in several badly involved joints may have the effect of shortening the whole process.

Since the immediate effects of the operation are to improve the mechanics of the damaged joint, it is thus seen that the first and important purpose is to restore the functional capacity of the joint as promptly as possible. As a byproduct of this result it becomes a corollary purpose to assist in restoring the individual to a more normal mode of existence which will indirectly thereby improve his hygiene, his metabolism, his eliminations and his resistance to further progress of the disease in the other involved or uninvolved joints which have not been operated upon.

The indications for this operation have been sufficiently clear in the statement of the purposes of the operation and so far as my personal experience goes, they are very largely as I have thus outlined them. However, since this is intended to be a statement of the present status of synovectomy, it is fair to call attention to the fact that Dr. Sneed reports excellent results following synovectomy in (1) syphilitic synovitis; (2) true traumatic arthritis accompanied by lipping, destruction of the semilunar cartilages, erosion of articular cartilages, and obliteration of the joint space; (3) benign tumors of the knee

joint; (4) osteochondromatosis with numerous free and attached bodies. Furthermore Ellis Jones says that in quiescent lesions he does not consider bony changes, such as lipping and osteophyte production or destruction of the semilunar cartilages and obliteration of the joint space, contraindications to operation. In fact several of his cases in which excellent functional results were obtained presented exactly such a picture.

The results of the operation have left me in a state of confusion, there having been, however, no disturbing postoperative complications. In all my cases there has been a fairly prompt restoration of a satisfactory functional state in the operated joint as an immediate result, but in several instances there has followed a relapse and in others there has been a gradual progressive crippling of other joints. I am, however, impressed by the probability that the further progress of the infectious arthritis in these unfortunate instances was largely conditioned by inadequate follow-up observation and treatment, or that it occurred in the relatively few instances in which the operation was undertaken in the wrong type of case and at a time when the exact indications for the operation were less well understood. On the whole, it is my impression that in properly selected cases the local result of the operation is a fairly prompt and very satisfactory restoration of the joint function. Constitutionally the results are favorable to an improvement in the patient's general well-being in proportion to the extent of his improved ability to walk and to carry on a normal mode of existence. It seems to me also that occasional unsatisfactory results may be accounted for by the fact that the operation was done at a time when the patient's general nutrition and resistence were at such a low point that the added burden of the operation actually hindered the spontaneous resolution of the exudate in other joints or prolonged the period of such resolution or permitted further extensions of the disease.

In several instances there has been occasion to reopen a joint several months after a synovectomy and there has been found a restoration of the membrane. Keyes in his brilliant research has shown what happens histologically after synovectomy. He found "In the rabbit the joint is again approximately normal sixty days after hemisynovectomy. The new synovial membrane is formed in situ by metaplasia of underlying connective tissue cells and there is little or no tendency for surface growth from the edges to cover the denuded area as occurs in the repair of a defect in an epithelial surface. The synovial cells are connective tissue cells slightly specialized by their location of a free connective tissue surface.

One of the greatest disadvantages of the operation is the fact that a temporary successful synovectomy may be followed by a relapse of the arthritis in a synovectomized joint or joints. This naturally is a very discouraging occurrence and might at first glance seem to be of sufficient importance either to make us hesitate to carry out the procedure or to abandon it altogether. I feel, however, that since a relapse in chronic infectious arthritis is a common experience in all plans of treatment we should look upon this regrettable phenomenon as we do when considering other plans of treatment.

Some help in evaluating the benefits of this procedure may be gained by reference to the results obtained by other surgeons. At the last meeting of the American College of Surgeons in Boston in October, 1928, the orthopedists of the Massachusetts General Hospital reported on a series of approximately 50 cases of synovectomy which had been done since 1923 and not including any case operated on less than a year previously. They were able at this clinic to bring back a large number of patients to exhibit the operative results. I must say I was surprised and pleased to see such a large number of satisfactory results and to find so many previously extensively crippled individuals restored to a considerable degree of usefulness. I

was also gratified to find at that clinic they were apparently confining the use of synovectomy to exactly the type of case in which it seems to me that the operation is most definitely indicated, namely delayed resolution in chronic arthritis. Dr. Gibson of Winnipeg recently informed me that he had secured very satisfactory results from this procedure, particularly in smaller joints and fingers in which he had been able to restore excellent functional capacity in a number of cases of marked disability of the hands. In a recent personal communication Dr. Carl Badgley of Ann Arbor, Michigan, told me that he has operated upon some 40 cases following this method and that he had in general been very well pleased with the results obtained.

On the whole, therefore, it would appear that in properly selected cases synovectomy has a very definite field of usefulness but it is not in a sense a panacea. Disappointments may follow its use, either in the form of continued progressive disease in the joints, or relapse in the operated joints. The extent to which the operation may be found to be indicated will probably depend to a large degree upon the efficiency of the early treatment or the severity of the process and its resistance to the accepted methods of treatment.

THE PREVENTION AND TREATMENT OF CONTRACTURES FOLLOWING CUTANEOUS BURNS*

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THE amount of deformity resulting from the contracture of scar tissue following burns depends upon the degree of the burn, the area and location of the surface involved and the period of time it takes to complete the healing of the wound.

In burns of first and second degree intensity there is no gross loss of tissue, as they do not involve the entire thickness of the skin and consequently no cicatricial tissue is formed. In third degree burns the entire thickness of the dermal tissue is destroyed and before this area is recovered with epithelium a varied amount of scar tissue may be produced. Deformities the result of cicatricial contractures are greater when the lesion is on a flexor surface than when on an extensor.

The longer a bare surface remains uncovered by epithelium, the thicker and less vascular become the granulations, resulting in an excess of scar tissue and a maximum amount of contracture. Therefore the more rapidly a wound heals, the less scar tissue will be produced.

In the treatment of burns the time may be arbitrarily divided into three periods.

In the first or immediate period, the time from the inception of the burn to the separation of the eschar, the indications are to save life.

In the second or intermediate period, the time from the end of the first period to the complete covering of the wound by epithelium, the indications are to hasten healing, thereby lessening the amount of scar tissue formation and preventing contractures.

In the third or late period the indications are to correct deformities.

Formerly the methods of treatment of

burns were directed towards the care of the local lesion and the patient was allowed to die or live to suffer for days. It has only been suspected in the last ten years that the late shock and toxemia in patients with burns were the result of absorption of poisons from the destroyed tissue; and attempts since then have been made to prevent it. In 1925 Davidson of Detroit introduced the so-called tannic acid treatment of burns. This consists of the application of a freshly prepared 5 per cent solution of tannic acid to the burned area until the destroyed tissue is tanned and thereby rendered non-absorbable. This has resulted in lowering the death rate from severe burns by 50 per cent. This method also decreases pain, lessens the amount of infection, promotes healing beneath the eschar, and on the separation of the latter from the bare surface, the granulations are in the most favorable condition for immediate skin grafting.

The parchment-like eschar protects the wound from trauma and seals it off from contamination. As the eschar separates at its edges and curls up, it exposes normal skin when the burn has been of second degree intensity and rapidly advancing skin edges where the entire thickness of dermis has been destroyed.

The granulations, covering a bare surface from which a tanned eschar has recently separated, are thin, vascular and free from infection.

The tannic acid method is the most satisfactory treatment so far advocated in burns.

On separation of the eschar, wound healing should be promoted to limit the amount of scar tissue formed. In the case of small areas the epithelium of the skin edges and islands, where cells of the hair follicles remain, should be stimulated. This is best done by strapping with strips of adhesive plaster in a fenestrated manner. When the bare surface is large, skin grafting has to be performed. Grafts grow better on young granulations than on old. In old granulation tissue, the blood supply is depleted by the constriction of the vessels due to the contracture of the scar tissue in its deeper layers. Therefore old granulation tissue is pale in color and less resistant to infection.

Autogenous grafts are more successful than homologous, the latter type being seldom used.

Grafts composed of epidermis alone are not satisfactory as the skin developing from them is thin, abrades easily, is firmly attached to underlying scar tissue which contracts, frequently breaks down and does not stretch to accommodate itself to the movements of the part. The Ollier-Thiersch and Reverdin are grafts of this type.

Full thickness or deep "pinch grafts," placed close enough together, form skin which has not these objections. The technique is simple, the dressing and splinting are of importance. Later strapping with adhesive plaster will increase the rate of epithelium growth.

When flexor surfaces are involved, the part must be kept in extension during the healing process. This can be accomplished by position of the part, splinting or traction.

When deformities have resulted from contractures, operative procedures to relieve them should not be attempted until the contracture of the cicatrix is complete, the scar having lost its pink color. This is seldom before a year has passed. During this period, physiotherapy, occupational theraphy and splinting or traction may be of benefit in restricting the amount of deformity.

Plastic operative procedures should be carefully planned and slowly carried out in several stages. Most failures are due to attempting too much at one time, as new blood supplies have to develop between operations.

Wolf or full thickness grafts and pedicle flaps are procedures frequently used. The full thickness graft is applicable to surfaces on which normally there is little subcutaneous fat, as the hands and feet. The pedicle flap may be used on the face, arms, legs and where scars are adherent to bony surfaces.

THE USE OF FASCIA AS SUTURE MATERIAL*

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NEW YORK

THE use of living fascia has been a distinct advance in surgery, and especially in the surgery of hernia. It has been in use long enough and in a sufficient number of cases so that we can gauge its exact worth and know its limitations. There is no question but that living human fascia is much better than animal fascia or animal membrane which has been preserved in chemicals. I have used ox fascia in a number of cases, have felt that its use is not as satisfactory as when living human fascia is used, and have discarded it. I think it is perfectly permissible to use fresh fascia from one patient to another, and have done this in several instances with complete satisfaction. Any danger that syphilis might be transferred from the donor to the recipient is, I think, quite improbable.

It has been proved by animal experiments that when living fascia is inserted into a wound, many of its cellular elements remain imbedded in the scar. I have felt for some time that it should not be relied on actually to hold tissues together and therefore, should not be used under tension. For this reason, of late, it has been my custom in hernias with large openings, especially ventral hernias where there is some difficulty in bringing the layers together, to do this with chromic gut sutures which hold the layers together for a certain period of time, during which the fascial suture which has been laced backward and forward over this suture lines will take as a living graft. We have now done 443 cases in this hospital with 28 traced recurrences. We have reserved it for the difficult hernias, the very large indirect hernias, a great many of the direct, and many of the umbilical and ventral. In some instances, we have used it in cases which in former years we should have considered inoperable. Recently I did a Gallie operation on a large ventral hernia in a stout man using the chromic gut retention sutures and the fascial sutures above; and I feel that if he had been operated on by the older overlapping method, his trouble surely would have recurred.

We have now systematized the operation by using two operating teams working simultaneously, one on the hernia and one removing the fascia so that the fascia is ready for use when the hernia is dissected and the operation takes practically no longer than the old method.

Of course, there is a slightly greater chance of infection on account of the double operation. We had one bad infection where the whole wound was opened up and the fascia could be seen sloughing resembling the sloughing tendons in a suppurative tenosynovitis. We have had a few cases where there has been a slight serous discharge persisting for some time, but whether it came from the fascia or not it was impossible to tell. The removal of the fascia from the thigh is an exceedingly difficult procedure to accomplish under a local anesthetic, but a spinal anesthetic can be given, or the fascia can be removed from another patient under a general anesthetic and immediately used in the patient on whom the local has been used.

A very few patients have complained of pain and tenderness in the scar in the thigh for a long time. I have one patient who has developed a tender fibrous thickening almost resembling a fibroma, which may have to be removed later; but it is surprising how the fascia seems to grow back in place so that there is no herniation

of the thigh muscles. The fascia of the thigh is much thinner in women than in men, especially so in the short fat women who so frequently have large hernias in which a Gallie should be done. When the strips are out, they are often found to be so slender as to be practically useless; and here again, it may be advisable to use the fascia from another patient operated on at the same time.

Another field in which fascia can be used with success is the open treatment of fractures. Here again, a warning should be given about its use under tension. I heard of a case recently where fascia had been used in a case of acromic clavicular separation where there was considerable tension and in which the separation reappeared. It seems to be probable that where fascia is used to hold together fractured bone surfaces, as for instance, a fracture of the patella, the fascia actually lives and becomes adherent to bone if not under too great tension. Patterson[1] advises the use of living and chemically preserved fascia as a means of fixation for fractures. His assumption is that the fascia lasts longer than kangaroo tendon or chronic catgut. Of course, it is perfectly possible that here also the fascia persists indefinitely as a living graft in the scar of the operation.

In conclusion I would say that our experience here for the last three years has led us to believe that we should use freshly removed autogenous fascia in all large indirect hernias, all direct hernias with weak musculature and all large ventral and umbilical hernias. Also that it is a good material to hold fractures in place provided that there is not too much tension on it.

[1] Patterson, R. H. *Ann. Surg.*, 88: 879, 1928.

THE INJECTION TREATMENT OF VARICOSE VEINS*

Ralph Charles Kahle, m.d.

NEW YORK

FOR the past few years papers on this subject both in this and the Old World literature have again brought to our attention the earlier work of Linser in Germany and Sicord in France, on the chemical obliteration of varicose veins. In the begining Linser used sodium chloride solutions and Sicord used sodium carbonate solutions. Many of us have noted in our own experience the obliteration of veins in the cubital area with injections of salvearsan preparations.

This method of the obliteration of varicose veins has been received with skepticism; but upon clinical experience has revealed many satisfactory results. These reports came in from various scattered surgeons throughout the world.

With the consent of Dr. Royal Whitman, I have undertaken to establish the efficacy of this treatment. This is to be a demonstration and not a study of end-results. Any suggestions will be appreciated.

The theories of the origin of varicose veins will be passed over by naming them only:

1. Congenital weakness of the veins.
2. Endocrine-ovarian disturbances.
3. Loss of nervi-muscular tone.
4. General weakness of connective tissue.
5. Phlebosclerosis.
6. Syphilis.
7. Infections of multiple, segmental type.

Having demonstrated by the Trendelen-

burg method that the deep veins are patent, the choice of solutions is at one's disposal. I have chosen sterile aqueous sodium salicylate in 20, 30, 40 and 50 per cent solutions. The quantity of these solutions injected to produce a chemical irritation of the intima depends on the diameter of the vein to be injected. A personal judgment is formed after failures only.

The syringes that I have employed are of the Tuer type of 3 c.c. to 5 c.c. size fitted with a 26 gauge needle of the length one's fancy or experience may dictate. A normal saline is kept on hand to dilute the solution when accidentally injected outside of the vein, to prevent necrosis of the subcutaneous tissues.

The question of using or not using a tourniquet is best decided upon by the operator's experience. I prefer a tourniquet above the area to be injected, employed only to demonstrate the filled vein, with removal of same as soon as the injection has been made. Then the patient holds with firm pressure a sterile gauze 2 in. by 2 in. square over it for ten minutes. This prevents leaking of the solution back into the tissues. I use tincture of iodine ½ strength to prepare the site of the injection.

The position of the patient is usually one of standing while the injection is made, with recumbency following immediately after the needle has been withdrawn, and rest for ten minutes. After this he resumes his usual vocation with very little discomfort; a marked step in progress over the operative confinement and anesthesia effects of the variously described surgical procedures.

Pain usually accompanying or immediately following the injection is only of a transitory type. It is at the site of the injection and usually for a distance of 6 to 10 in. below the injection site along the course of the vein. Sometimes it is present for a short distance above the injection site. It is spoken of as a cramp-like pain.

No sloughs or systemic reactions or emboli have so far been noted. There are 2 cases of fatal results reported in the literature: one by Hohlbaum,[1] apparently proved to be a fat embolus; and one by Hammer,[2] quite distinctly a case of mercurial poisoning, starting a few hours after the injection of a mercurial preparation and dying twelve days later with typical mercurial poisoning symptoms. Nine other cases have since been reported.

The resultant thrombosed areas are here demonstrated immediately after and for several weeks after the injections have been made. They resemble a great deal the phlebitis case one is familiar with in practice of unknown cause. A similar edema of the parts below the injection is noted for a number of weeks after the obliteration. Cord-like thickenings of the veins injected are felt after several days and for several months afterward. They appear reddened and tender. A hot water bottle or electric pad relieves discomfort after a day or two following injections in sensitive individuals. None of my injected patients have been "laid up" from their usual occupations.

At a later data I hope to demonstrate cured cases for a critical end-result study.

[1] HOHLBAUM, J. Zentralbl. f. Chir., 49: 218, 1922.
[2] HAMMER, F. Deutsche med. Wchnschr., 45:45, 1919.

RECURRENT DISLOCATION OF THE SHOULDER
ITS TREATMENT BY TRANSPLANTATION OF THE LONG HEAD OF THE BICEPS*

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NEW YORK

I WISH to demonstrate another new procedure for recurrent dislocation of the shoulder. After reviewing the literature on this subject, one is impressed by the great variety of operations for this condition. They range from prolonged fixation of the shoulder to bone operation. This operation presented here utilizes the long head of the biceps to correct the condition. On the cadaver where it was worked out, the head of the humerus could not be dislocated even after all the muscle and capsule were divided.

The incision begins at the clavicle just above the coracoid process. It extends down for 4 in. along the anterior aspect of the deltoid muscle between the pectoralis major and the deltoid. The long head of the biceps is then exposed and divided, ½ in. above where it dipped under the pectoralis major. The proximal end is then exposed up to its insertion, the superior surface of the glenoid. A hole is then drilled through the head of the humerus beginning at the bicepital groove, at the level of the transverse humeral ligament, and extends upward so that the drill will come out near the center of the head; a ¼ in. drill is used. The proximal section of the long head of the biceps is then passed through this canal and re-sutured upon the distal cut end. It is possible too verlap this ½ in. Black silk is used for it. The wound is then closed in layers and the upper extremity placed in a Valpeau bandage with the elbow flexed to 45°. This is kept up for three weeks, following which the patient is encouraged to use the extremity.

*Read at Sixteenth Annual Meeting of Alumni of Hospital for Ruptured & Crippled, N. Y., Nov. 19-20, 1928.

CARCINOMA OF THE PENIS

TREATED BY THERMO-ELECTROCOAGULATION*

Budd C. Corbus, m.d., f.a.c.s.

CHICAGO

THE solution of the cancer problem lies in the early recognition of the disease and its adequate treatment.

A

Sheet of rubber

Inactive electrode

Nelaton catheter

B

C

Catheter sutured in place

Fig 1
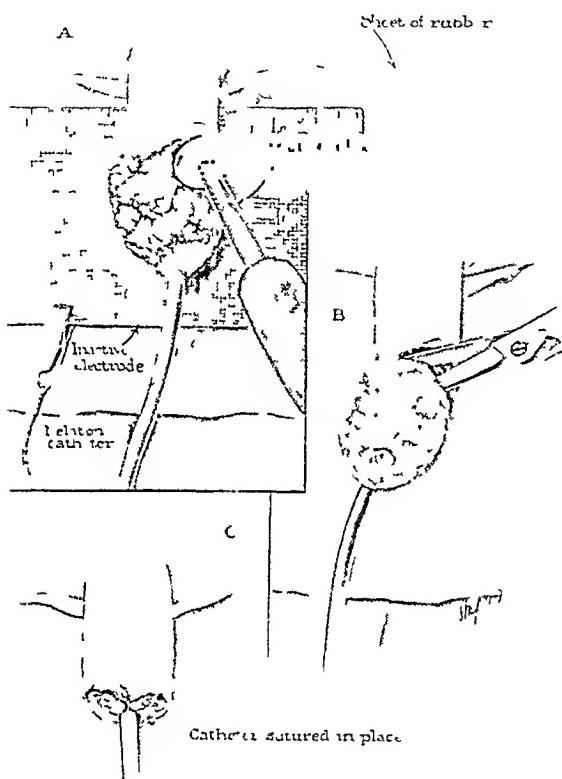
As carcinoma of the penis is often a late sequela of chronic balanitis due to phimosis, early circumcision should be encouraged. However, if there is the slightest evidence of a beginning carcinoma, circumcision should not be performed until many months after the growth has been destroyed by thermo-electrocoagulation.

With an early diagnosis and immediate and proper treatment, the prognosis is excellent. In late diagnosis, even with skillful treatment, the prognosis is fatal.

According to the best authorities under no circumstances should a section of a growth be removed for diagnosis by simple excision unless followed immediately by some form of coagulation. In order to safeguard any metastases it is preferable to remove tissue for biopsy immediately preceding the thermo-electrocoagulation.

The following technique is suggested for those advanced cases of carcinoma of the penis that have heretofore had the organ completely removed by surgical excision. While the method does not offer a cure, it removes the foul fungating mass with a minimum chance of disseminating the metastases that have already occurred, at the same time leaving a part of the penis in a normal condition. If the coagulation is complete, there will be no reoccurrence in the stump.

For the metastatic growth that has already occurred in the regional glands, either roentgen rays or thermo-electro-coagulation may be employed.

A. A heavy rubber sheet is placed over the thighs, beneath which are placed several layers of gauze moistened with water. On top of the rubber sheeting is placed the inactive electrode. The penis with a Nelaton catheter that has been passed into the bladder is layed flat on the inactive electrode. With the active button electrode the whole mass is cooked white, taking enough of the healthy tissue to insure complete destruction of the growth.

B. The method of cutting away the coagulated tissue: The margin of the incision should be kept within the coagulated tissue in order to avoid hemorrhage and should not sever the catheter. Unless the coagulation is carried to the point of escharing the catheter will not be destroyed.

C. On the stump of the penis, catheter in situ, the retention sutures should be carried through the skin. The catheter may be removed on the twelfth postoperative day.

MASSIVE ATELECTASIS OF THE LUNG FOLLOWING PELVIC FRACTURE*

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NEW YORK

MASSIVE atelectasis of the lung has been reported frequently as a sequel of abdominal operations, chest wounds, and postdiphtheritic paralysis.[1] Relatively few cases are on record, however, in which this condition has followed simple fracture.[2] The present case belongs to the latter class, being one of pelvic fracture followed by massive atelectasis of the left lung. It also illustrates well the displacement of the mediastinal structures to the left.

F. T., a well-developed white male, thirty-two years of age, was admitted to Staten Island Hospital March 12, 1928. He had sustained an injury from a falling heavy box, and as a result he complained of pain in the left groin and the sacral region. Physical examination revealed moderate tenderness in these regions, but the skin was intact and there was no swelling nor ecchymosis. The examination otherwise was quite negative. No lesions were found in the head, neck, thorax, abdomen, or extremities.

A roentgenogram of the entire trunk was taken on admission. This showed that the lungs were of equal density, that the heart was normal in position and size, and that there were no fractures above the pelvis. The following pelvic fractures, however, were revealed: an oblique fracture through the pubic crest on the left side; a fracture through the inferior ramus of the left pubic bone at the ischiopubic junction, and a separation of a small fragment from the inferior border of the superior ramus of the left pubic bone slightly anterior to the iliopubic junction. These fractures are designated by arrows in Figure 1.

The daily progress of the case may be presented as follows:

March 12. Patient resting comfortably. Temperature at 4 p.m., 99.4°F.

March 13. Temperature at 8 a.m., 98.6°F. The patient rested comfortably till 11 a.m. when his face began to flush and his respiratory movements became labored and moderately increased in rate. His pulse and temperature rose markedly. At 12 noon, the latter was 101.0°F. and it continued to rise to its maximum of 104.2°F. at 4 p.m.

Examination of the chest at 1 p.m. showed absence of breath sounds, flatness to percussion and absence of tactile vocal fremitus on the left side below a transverse plane passing through the xiphisternum. At 3 p.m. these physical findings were elicited over the entire left side of the chest beneath a horizontal plane through the third costal cartilage.

A roentgenogram taken at 3 p.m. showed a dense shadow obscuring all lung markings in the lower two-thirds of the left side of the chest. It also showed a *definite* displacement of the heart and mediastinal structures to the left (Fig. 2).

The patient's leucocyte count at 9 p.m. was 12,300, there being a distinct polymorphonu-

[1] Consult the following for a more extensive consideration of this subject:

   a. Pasteur, W. *Brit. J. Surg.* 1: 587–601, 1914.

   b. Elliot, T. R., and Dingley, L. A. *Lancet,* 1: 1305–1309, 1914.

   c. Bradford, Sir J. R. Oxford Medicine, ii: 127–137.

   d. Lee, W. E. *Ann. Surg.,* 79: 506–523, 1924.

   e. Jackson, C., and Lee, W. E. *Ann. Surg.* 82: 364–389, 1925, and *Trans. Amer. Surg. Ass'n.,* 43: 723–766, 1925.

   f. Scott, W. J. M. *Arch. Surg.* 10: 73–116, 1925.

   g. Churchill, E. D. *Arch. Surg.* 11: 489–518, 1925.

[2] Cf. *a.* Rigler, L. G. *Minnesota Med.,* 9: 326–333, 1926.

   b. Edkin, D. K. *Ann. Surg.,* 86: 885–889, 1927.

March 14. The clinical picture remained practically unchanged till 12:30 A.M., when the patient began to cough, expectorating a thick,
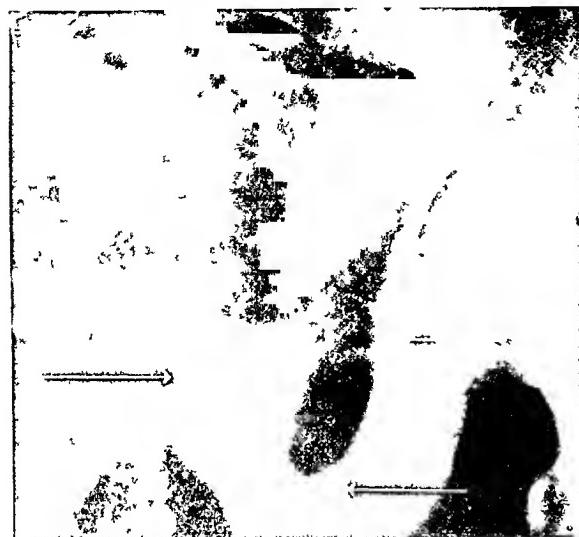
FIG. 1. Roentgenogram of involved portion of pelvis, taken March 12, 1928. Fracture positions indicated by arrows.

tenacious, greyish-white mucoid sputum. It contained no blood and was found negative for tubercle bacilli. Several hours later, breath sounds began to be audible over the lower two-

March 15. The patient continued to cough and expectorate sputum of the character described, and he was instructed to lie on his right side to facilitate drainage of the left bronchi. The breath sounds became more nearly normal over the affected region of the chest. The patient's leucocyte count was 11,200 with a definite polymorphonucleosis.

March 16. The patient continued to cough and expectorate the characteristic sputum. A second roentgenogram was taken which showed a marked decrease in the density of the shadow in the left lung, though the heart and mediastinal structures remained considerably displaced to the left. This picture also showed that the left dome of the diaphragm was somewhat elevated. (Fig. 3).

March 17. There was little change in the clinical picture, except that the temperature was showing a definite tendency to return to normal. The patient continued to cough and expectorate the characteristic sputum.

March 18. On this day, the temperature did not rise above normal. The patient coughed less and rested more comfortably than previously.

March 19. The temperature remained normal, and the pulse and respiratory rate had

FIG. 2 Roentgenogram of chest taken at 3 P.M., March 13.

FIG. 3. Roentgenogram of chest taken March 16

thirds of the left side of the chest. Tubular breathing was heard at the angle of the left scapula and anteriorly at the base of the lung. At the same time, tactile vocal fremitus returned.

become, by this time, practically normal. Expectoration of the bloodless, mucoid sputum ceased.

March 20. The temperature remained normal. A roentgenogram of the chest showed that

the shadow on the left side had practically disappeared and that the heart and mediastinal structures had returned almost to their normal position. Slight elevation of the left side of the diaphragm, however, still persisted (Fig. 4).

Here, then, is a case of massive atelectasis of the left lung which developed about thirty hours after fracture of the pelvis. Within twenty-four hours after the onset of this condition of atelectasis, it began to resolve, the patient expectorating probably from 30 to 50 c.c. in all of mucoid, bloodless sputum. Resolution was progressive, with the result that the temperature had returned to normal five days after the onset of the atelectasis, and the chest had returned practically to normal seven days after its onset. Postural treatment was employed, the patient being instructed to lie on his unaffected right side and to cough freely.

FIG. 4. Roentgenogram of chest taken March 20.

The American Journal of Surgery

⸙ EDITORIAL ⸙

WHAT'S IN A NAME?

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NEW YORK

EVERY now and again one is made aware that there exists, even amongst those who ought to know better, an entirely wrong idea of what plastic surgery is. It gives one a curious sensation, after going through with three or four operations in a morning, any one of which may make serious demands upon the skill, knowledge and experience of a surgeon, to find in the conversation of some respected colleague a reflection of his inner conviction that the whole business is only an extension of the work done in the beauty parlor. After one gets accustomed to this he ceases to be annoyed by it, for the mental process is readily discernible. "The beauty parlor advertises plastic surgery; the Post-Graduate Hospital has a plastic surgery department; things which are equal to the same thing are equal to one another; therefore a plastic surgeon is a beauty doctor, which was to be proved." It is much as though one were to say, "Barbers were the first surgeons; in some countries the tradition of barber-surgeon remains, so that a surgeon does not call himself a doctor; therefore all surgeons are barbers." Nothing could be simpler. No doubt the confusion is due mainly to the fact that more people read the newspapers than the dictionary, for there the definition is entirely accurate, plastic surgery being described as that which has to do with molding, modeling, renewing lost parts and rectifying deformed parts of the body, with restoring and healing where there are such deformities. If people will insist that it means nothing but face-lifting, what can be done about it? Even

if one gets to calling it reparative or reconstructive surgery, with some notion of making a concession to the mistaken mood of others, the chances are that these latter are not in the least impressed. They do not want to change their opinion, a common enough human trait even with those who have had medical training.

But as to what the fact is, supposing the truth to be of some importance to minds not sealed against it, perhaps something will appear from the following list of operations, performed in the mornings of one month in this present year in the department of Plastic Surgery at the Post-Graduate Hospital:

Severe burn of face; making of new eyelid. Repair of syphilitic nose of the second order. Excision of basal-cell carcinoma of nose; to be repaired later. Basal-cell carcinoma of orbit. Severe burn of chin and neck. Removal of large keloids from arm. Fractures of superior maxilla and of nasal bones. Carcinoma of floor of mouth. Empyema of antrum; skin grafting. Severe ectropion of upper and lower lids; graft from other lid. Reconstruction of nose after motor accident; 2 cases. Closure of sinus posterior to ear. So-called "inoperable" cleft palate; 2 cases. Hare lip; 3 cases. Repair three years after excision of cancer from floor of the mouth. Bone graft to jaw. Repair twenty years after tracheotomy. Keloid scars on face and neck. Paraffinoma of nose and cheek. Replacement of nose; total loss from lupus and syphilis. Restoration after total loss of ear. Roentgen-ray burns; 2 cases. Radium burn. Severe fire burns; 3 cases. Unilateral facial paralysis. Cancer of larynx. Depression from scleroderma. Restoration of orbit, after motor accident. Ear, cheek and nose lacerated by wind shield. Trismus of jaw. Cancer following radium treatment for removal of port-wine stain. Intractable scars after tonsillectomy. Adherence of palate to pharynx; syphilitic. Several cases of nasal disfigurement from various causes, in which distortion of the parts involved limitation of function.

It will hardly be contested that such a series calls for a knowledge and practice of surgery of an order not to be despised. There is nothing in the whole list that the so-called "beauty doctor" would consider to be within his province, or that he would venture to grapple with.

What is true is that, underlying all this range of surgery, which might be expanded almost without limit, there is a certain simplicity. One learns that the Thiersch graft has the quality of dependability. Then, when confronted with a problem, perhaps entirely new, one asks whether the Thiersch graft is likely to serve the immediate purpose. Will it do to replace the burn scar at the axilla by which an arm is immobilized? It will; and when it has done so the function is restored. Will it serve for a new lining of the antrum? It will; and there is an end of all those disgusting excretions. Will it serve to make a new lachrymal duct? It will; and again function has been restored and a great annoyance has been removed. There is nothing too small for it, nothing too large; one can take from the skin surface, practically without discomfort to the patient and with almost no bleeding sufficient to cover any defect encountered in practice. This one translucent shaving of skin is the key to success in a vast and continually expanding range of surgery.

Similarly with the Wolfe graft; once it has been made reasonably certain, and the efficiency is now better than 90 per cent, that the full-thickness skin graft will live under known pressures, one can proceed with excisions of a size that could not before have been covered. One can take away the skin that has been exposed to the ravages of lupus, or syphilis, and with all confidence set about replacing it.

Or consider the potential of the pedicle graft, which can be used where it is freed or can be migrated from the abdomen to the face. If one is certain of its efficacy, one does not shrink from taking away the whole side of the face, if necessary, confident that replacement by this method will repair the loss. Both the Wolfe and the tubed pedicle are factors of the highest efficiency in the surgery of cancer, and if the recent intensive development of plastic

or reparative surgery had done nothing else than to produce the confidence with which, because of the demonstrated capacities of these grafts, one approaches these cancer problems, plastic surgery would have justified its existence. It is probably true of this, as of most other new ventures, that those who were present at the beginnings did not foresee a tenth of its possibilities of expansion. The inventor of the steam engine had no conception of the uses that were to be made of it; Bell did not foresee the expansion of the telephone; Marconi did not vision the radio receiver in every home. These expansions flowed from the simplicity of their beginnings. It is the same here; each new day proves that the underlying principle, based on the practicability of transferring tissues from one part of the body to another part of the same body, is applicable to some condition met with in civil life that was never thought of when the surgeons in the war hospitals were adapting, as emergency measures, those procedures which had been elaborated by Szymanowski and others long before but in such obscurity that but for the books they wrote the memory of their patient labors would have been lost.

For example, when Szymanowski wrote there was no radium and there were no roentgen rays. In our day we not only have these but we have to reckon with the burns they leave, the scars that are produced by their use, the tissues devitalized by their employment, the dysfunction that results, and the malignancy that threatens. It is not too much to say that, where these potent agencies have passed beyond the control of those who used them, and the sequelae mentioned have developed, practically the only relief to be had is that which reparative surgery can give. The number of instances in which such intervention has been effective probably is not even suspected even by those who are abreast of the times; certainly not by those who have failed to sense the true meaning of this latest surgical specialty.

Considering that in the delicate surgery required in the orbital area the principle of transplantation has been recognized and highly developed, it is perhaps a little odd that the possibilities of transplantation as applied to more extensive areas were not recognized long before they were. Indeed, even in this field, until recently, it seemed as though limits had been set to surgical imagination. The Thiersch graft is now used not alone to cover defects on the lids, in certain conditions, but has proved to be the only physiologically acceptable lining for a socket from which the eye has been extruded. Again, the repair of an eyelid by transfer of a graft from a sound upper lid, on all counts the best and most satisfactory method in many instances, owes its introduction rather to reparative than to ocular surgery. And the employment of these same eyelid skin grafts to cover small facial defects, the grafts matching more perfectly than any other the skin surroundings in which they are placed, is a method likewise evolved in the plastic surgery clinic. Once the problems of the restoration to life of the transplanted full-thickness graft had been mastered, it was inevitable that attention should be directed to the possibilities inherent in the eyelid skin, the thinnest to be found on the body; which can be spared (from the upper lid) without injury, in quantities greater than anyone would have suspected; and which "takes" practically 100 per cent.

At the other extreme, from the viewpoint of severity of intervention, may be cited the taking of fascia lata from the thigh, or of cartilage from the costal crest, neither, of course, more serious than the removal of bone for purposes of transplant but both involving surgical concepts less familiar in experience. It is only lately that anyone has thought of unilateral facial paralysis as a problem to be associated with the tensile properties of fascia. There may be those who, once the possibility of nerve anastomosis has been rejected, decline to admit that the disfigurement resulting

from the overbalance of muscles is worthy of a surgeon's consideration, but even these must concede that the dysfunction which at times is incidental to the condition does command attention. In either case, the position is dominated by the fact that fascia, carried in strips under the skin and even through the subjacent tissues, will live in its new environment and will respond to the strain required of it.

The cartilages also come into the picture and cannot be ruled out of it. One may be callous enough to hold that if a fellow human is unfortunate enough to have the constituents of his nose distorted he should be content to go through life sorry for himself and not be granted any surgical aid to betterment; but if these distortions are productive of entire or partial closure of the airway, as so often happens, the threat to the general health is universally admitted to be of such importance that the best efforts of the surgeon are not merely justified but commanded. Now it happens that, in part, the support of the nose is maintained by the presence of cartilage; it has been so ordained by nature that the presence of cartilage is essential to some of the nasal functions. If it is absent from where it is needed the loss must be made good. Not until very recently has it been recognized that there may be enough material for the actual purpose to be obtained from the excess of lower lateral cartilages occasioned by the hypertrophy that follows trauma too long neglected.[3] If this resource is unavailable, or insufficiently, then there is nothing for it but to invade the costal crest, the ultimate justification for that insult being that the cartilage not only supports the bridge but lives, thrives and is accepted in its new situation, where any and every foreign body that might afford support is doomed to expulsion, with all the attendant details of inflammation, abscess, and perhaps infection.

Certainly those who make light of this order of surgery are out of court when confronted with the consequences of surgi-

cal error. There is, for example, a well defined type of nasal disfigurement which is to be traced to resection of the septum without allowing sufficiently for the strength demanded of the supporting buttress that remains. The patient owes to this error a simulated hump at the nasal bones, a depression at the cartilagenous bridge, a retracted columella, a drooping nose tip, and impaired breathing. There are, again, after tonsillectomy, instances in which essential muscles of the pharynx are found to have been immobilized, either by direct injury or by cicatrices. Besides the discomfort, there may be definite impairment of voice production. Were it not for the certain knowledge that, after the incidental surgery, difficult in the very nature of the circumstances, a Thiersch graft here and perhaps a mucous membrane graft there will free the area from the danger of later constriction, the errors which produced the condition would be irremediable, the suffering of the surgeon in his self esteem being added to the suffering of the patient in his person. Still another interesting development is to be noted in the mentioned cases of "inoperable" cleft palate. Here, after the tissues commonly utilised have ceased, after several failures, to afford a further supply. reparative surgery addresses its attention to the tonsillar tissues, from which a soft palate can be formed, paving the way for articulation in voice production.

It will be noted that in the list of cases cited for a single month, and that a month in which motor traffic is, probably, at its nadir, there were instances of wind shield injuries. These, a part of our ultra-modern civilization, have become both frequent and characteristic. There is a shearing, with variable loss, beginning at the ear and carried through to the nose and chin. The esthetic impairment is noteworthy. Is there any use telling the patient that it is unethical to try to replace what has been lost from his ear or his nose? If *a boy is born without an ear, and one can be*

made for him from his own tissues, who is to say he must go through life depressed by the consciousness of his deformity?

Enough has been said to indicate that, once mastery has been attained of the relatively few essential details of replacement by transplant, the field for their effective utilisation continuously and progressively expands. There is scarcely any limitation in either the number or the variety of cases; one is continually impressed by the volume of such ills, not in war conditions, where one expects them, but in the ordinary run of civil life, where one does not. Burns and explosions; trauma of all kinds and their sequelae; deformities congenital and acquired; dysfunction of various origin; sequelae of surgical error; disfiguring sequelae of disease; losses incidental to syphilis and lupus; and at the end of the road, cancer and the covering of defects incidental to the surgery to which it gives occasion; these are all parts of the problem presented, day in and day out, year's end to year's end. There seems to be no limit to what might be attempted, nor yet to the employment of what knowledge a surgeon may have attained, of any boldness with which he is gifted, of any skill he may have acquired. The test, if I may be allowed to predicate upon a single experience, is that, while there is a thrill in every instance and each case is different, in some particular, from every other, the inevitable drift, with every operator, is towards the alleviation of cancer. The whole arsenal, with every improvement that experience and practice can make to it, is envisaged, consciously or subconsciously, as contributory to this great end. Can more be said for any branch of surgery?

THE SAMUEL D. GROSS PRIZE

FIFTEEN HUNDRED DOLLARS

Essays will be received in competition for the prize until January 1, 1930

The conditions annexed by the testator are that the prize "shall be awarded every five years to the writer of the best original essay, not exceeding one hundred and fifty printed pages, octavo, in length, illustrative of some subject in Surgical Pathology or Surgical Practice founded upon original investigations, the candidates for the prize to be Americans citizens."

It is expressly stipulated that the competitor who receives the prize shall publish his essay in book form, and that he shall deposit one copy of the work in the Samuel D. Gross Library of the Philadelphia Academy of Surgery, and that on the title page it shall be stated that to the essay was awarded the Samuel D. Gross Prize of the Philadelphia Academy of Surgery.

The essays which must be written by a single author in the English language, should be sent to the "Trustees of the Samuel D. Gross Prize of the Philadelphia Academy of Surgery, care of the College of Physicians, 19 S. 22d St., Philadelphia," on or before January 1, 1930.

Each essay must be typewritten, distinguished by a motto, and accompanied by a sealed envelop bearing the same motto, containing the name and address of the writer. No envelope will be opened except that which accompanies the successful essay.

The committee will return the unsuccessful essays if reclaimed by their respective writers, or their agents, within one year.

The committee reserves the right to make no award if the essays submitted are not considered worthy of the prize.

WILLIAM J. TAYLOR, M.D.,
JOHN H. JOPSON, M.D.,
EDWARD B. HODGE, M.D.,
Trustees.

PHILADELPHIA, MAY 20, 1929
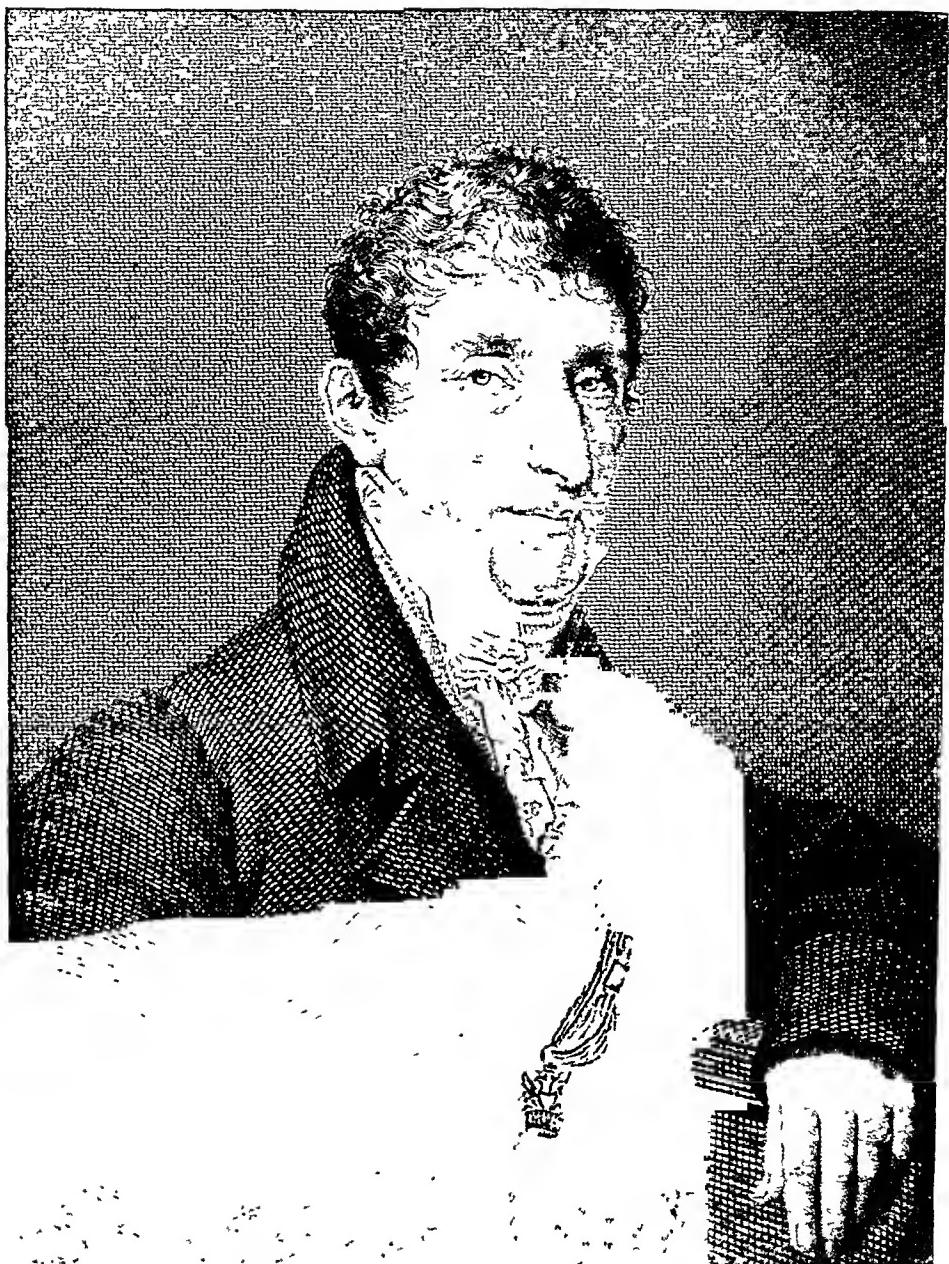
ANTONIO SCARPA

[1747-1832]
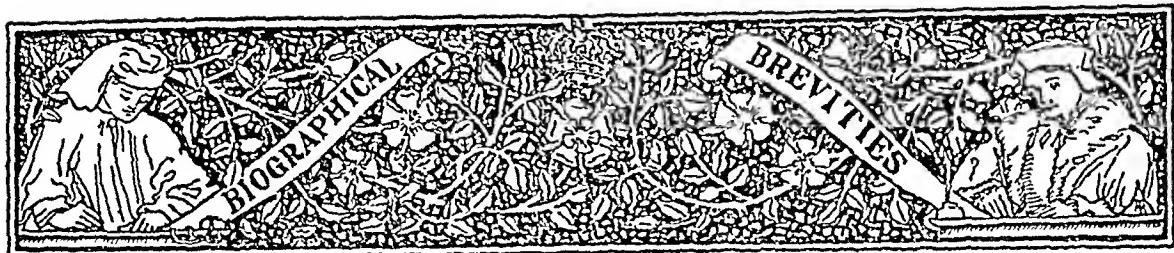
SCARPA'S TRIANGLE

ANTONIO Scarpa was born in 1747 and died 1832.

Physicians will remember meeting his name as students in their freshman or sophomore year anatomy course. One of the questions frequently asked an undergraduate is: "Bound Scarpa's triangle." Later in life as mature surgeons this triangle plays a routine part in certain operations.

Scarpa was a many-sided individual. He was a writer of note. He carried on independent investigations and made noteworthy discoveries. He was a great anatomist and also as a surgeon won renown in his day. As a surgeon he was skilled in several departments of this branch of medicine. He was exceptionally skillful as an orthopedist and an ophthomologist. To him is given the credit for the discovery of the membranous labyrinth, the nasopalatine nerve, and the triangle of the thigh which bears his name. He was the first to declare that arteriosclerosis is a lesion of the inner coats of the arteries.

As a writer he covered many subjects. He wrote a worthwhile book on hernia and eye diseases. He originated the procedure of iridodialysis. He devised and made a shoe for club-foot which is still sometimes used, more or less modified, by orthopedists. His greatest work was the "Tabulae Nevrologicae" (Pavia, 1794). In this for the first time is given the proper delineation of the nerves of the heart.

We read that Scarpa was "an irreproachable Latinist, a master of sarcasm, yet a most attractive teacher and a draughtsman of the first order" (Garrison).

He comes down the years as one of the few medical men who have illustrated their own books. His artistic skill was of the highest order. As an artist his fame would have endured the centuries. He trained Faustino Anderloni to execute the copper engravings from his drawings (Choulant). We quote from that student and expert of medical history, Garrison: "Scarpa's illustrations are the crown and flower of achievement in anatomic pen-drawing, while Anderloni's wonderful copper-plates of the same are comparable in *brio* with the work of Sharp, the Drevets, and other masters of the best period of line engraving."

After living a full life, a life of diversified vocations and avocations and interests, he died at the ripe age of eighty-five years.

T. S. W.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

THE INFLUENCE OF THE BRITISH MASTERS ON AMERICAN SURGERY*

ANDREW STEWART LOBINGIER, M.D., F.A.C.S.

LOS ANGELES

THE development of the science of surgery out of the inchoate practices of the barber surgeons forms a chronicle of the most dramatic interest.

The Hippocratean principles of the art of healing had slumbered for centuries in the abysmal gloom of monastic ignorance and superstition. The channels for the dissemination of intelligence were few and those which functioned were hedged about with formalities and impedimenta which dwarfed all consistent efforts toward literary and scientific progress.

When printing was invented in the fifteenth century an amazing change spread over the world's civilization. Through the medium of the printed page the knowledge of progress in science and art could now be widely disseminated. The record of invention and discovery could be published to a world now eager for learning and knowledge. The dawn of a renaissance of science and discovery, of letters and of art, which reached its zenith in Britain in the glorious Elizabethan epoch, has no counterpart in history since Greece's Golden Age of Pericles.

Into this radiant atmosphere of England's flowering splendor was born a boy whose original mind and genius for research soon placed him in the foremost rank in the study of the phenomena of life and function. William Harvey's discovery of the circulation of the blood and the physiology of generation were not only epochal; they served to establish for the first time in the history of medicine the fundamental basis for all subsequent anatomic and physiologic research and of all subsequent development in pathology and in surgical science.

There shines about the name and fame of Harvey a luster which the lapse of time has only served to render more significant and enduring. He lived and worked amid the companionship of England's most learned men in science and letters, the product of whose rich and resourceful minds constitute today the world's richest treasures in literature and art. His father-in-law, Dr. Lancelot Browne, had been Elizabeth's physician and as Harvey rose in favor he became himself the companion of princes and later physician and companion in travel of James I. Later still he held the same intimate association with Charles I, who was so ardent in his admiration of Harvey and his discoveries that he

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proved to be his most faithful friend and supporter. We know that he was friend and physician of the Duke of Lennox, of Lord Bacon and the Earl of Arundel and he must have known Shakespeare, who doubtless had intimate knowledge of Harvey's discoveries when he wrote: "The ruddy drops that visit my sad heart."

The early masters in Britain were among the first to formulate the study of anatomy and physiology into a system of correlated structure and function. There was a directness of approach in these studies which distinguished them from all other schools of scientific investigation. The celebrated schools of anatomy of William Hunter in London and of Charles Bell in Edinburgh were the direct result of this system of organized research. William Hunter, Percival Pott, John Hunter, the Monros, John and Charles Bell and Sir Astley Cooper composed a brilliant succession of masters and pupils, later to become teachers, whose influence and renown extended to three continents.

America especially benefitted by the instruction which our visiting students of medicine received at the hands of these British instructors. Once their fame reached our country, ambitious young medical students, who could afford the undertaking, braved the perils of the Atlantic, eager for the instruction in anatomy, physiology and surgery offered them in the schools of London, Glasgow and Edinburgh.

One of the first and most ardent of these young students was John Jones, who became a pupil of William Hunter in his school of anatomy and of Percival Pott in St. Bartholomew's Hospital. He was born in 1729 and died in 1791. He first studied medicine with Dr. Cadwalader in Philadelphia. Later he went to London to be with Hunter and Pott and afterwards visited the clinics of Petit, Le Dran and Le Cat et the Hôtel Dieu. In 1757 he took his degree in Medicine at the University of Rheims. Returning to America he opened offices in New York in 1753 and later returned to Paris.

While in London he was contemporary with John Hunter and while a student of his brother William became a skilful anatomist and formed a taste for operative surgery. He later returned to America, qualified to take a high place as a surgeon. Ten years after he had taken his degree at the University of Rheims he was made Professor of surgery in the Medical Department of King's College, just opened for instruction. He was the first American to be given a professorship in surgery. His biographer said of him: "He was well fitted by education and his various accomplishments to become the instructor of others; not merely as the skilful operator, but as the scientific surgeon and as the first teacher of surgery in the colonies, he justly deserves to be styled the Father of American Surgery."

Another of the early students of surgery to attain international fame was John Warren (1753–1815). He was a younger brother of General Joseph Warren, also a surgeon, who fell at Bunker Hill. Like his brother with whom he studied medicine, he became an ardent patriot and was at Concord and the first battle of Lexington. In 1780 Dr. Warren gave a course of lectures on anatomy with dissections at the Military Hospital. The following year the students at Harvard were permitted to attend his lectures. This lecture course finally led to the founding of the Medical Department in Harvard in 1783.

There were now three Medical Colleges of character in America: The Medical College of Philadelphia which became the Medical Department of the University of Pennsylvania in 1791; the Medical Department of King's College in New York which became the Medical Department of Columbia College in 1784, later in 1810 the College of Physicians and Surgeons; and the Medical Department of Harvard University. The leading spirits in the founding of these three great medical schools, which have had such an important part in the development of medical education in America, were almost all of them stu-

dents of the master anatomists and surgeons of London and Edinburgh.

In the beginning instruction in surgery was combined with the chairs of anatomy, chemistry and obstetrics. From now on these students of the British teachers demanded a distinctive place for surgery in the curriculum. Stephen Smith says: "This change in the system of surgical education was due to the genius of John Hunter, whose researches in the latter half of the eighteenth century gave to surgery the character, dignity and responsibility of a true science." While the teaching of the British scientists made slow progress in the schools of Europe on account of national prejudices and jealousies, they early took deep and abiding root in the virgin and fertile soil which the young and plastic schools of America afforded and through which they were to mould the character of its future surgeons. It was a fortunate circumstance that a corps of American students appeared at this critical time in the history of surgery in this country, thoroughly qualified by temperament and education to become the propagators of the principles and practice of the new faith through these pioneer schools."

It is quite impossible within the time limit of this address to consider with any degree of just appraisal the men whose avid desire for learning and superior endowments as teachers of surgery lent a singular distinction to their labors in our American Medical Colleges. Amongst the most celebrated of these teachers were:

Dr. Wright Post (1766–1828) who prepared for his medical study in the offices of Richard Bayley in New York. In 1784 he became a pupil of Mr. Sheldon in London and was an ardent follower of John Hunter's teaching and probably saw Hunter do his first ligation of the femoral artery for aneurysm. Later he returned to New York where he became professor of surgery in the Medical Department of Columbia University. He was the first professor of surgery in the College of Physicians and Surgeons and became president of the College in 1821 and continued in this office until 1826. Valentine Mott, one of his most devoted pupils, said: "He was unrivalled as an anatomist, a most beautiful dissector and one of the most luminous and perspicuous teachers I have ever listened to either at home or abroad."

In 1767 Valentine Mott (1785–1865) was given the chair of surgery in the College of Physicians and Surgeons, which was now raised to a full and independent professorship. At nineteen he entered the office of Dr. Valentine Seaman. He continued under the preceptorship of Dr. Seaman until his graduation from the Medical Department of Columbia in 1807. Dr. Wright Post was his professor of surgery. Soon following his graduation Dr. Mott visited London to become the pupil of Sir Astley Cooper. He also attended the lectures and clinics of Cline, Abernaethy, Blizzard and Home. He remained in London two years as Sir Astley Cooper's assistant in surgery. He returned to New York in 1809 and offered a course of lectures on operative surgery on the cadaver. The following year he was appointed professor of Surgery in Columbia on the advice of his former preceptor, Dr. Wright Post. He continued to hold the chair of surgery until 1826. Later he was professor of surgery at Rutgers College and later in the Medical Department of the University of New York. He was rated as a superior teacher and clinical surgeon, versatile in his learning and an educator of the highest character. He had been trained at home under his preceptor Wright Post, in the principles of John Hunter; abroad he had had a splendid training under Home, Abernathy and Cooper.

Alexander H. Stevens (1789–1869) followed Mott at the College of Physicians and Surgeons. A graduate of the University of Pennsylvania in 1811 he had the fine training in surgery from Philip S. Physick, who had had exceptional training in experimental work with John Hunter.

Willard Parker (1800–1884) succeeded Professor Stevens and was made professor of surgery in 1840. He was a graduate of Harvard and a pupil of Dr. John C. Warren. "Thus it happened that the chair of surgery once occupied by Jones and Post, then made illustrious by Mott, one of his own pupils, was next filled by a representative of Physick, and now was to be given to a student of Warren." Parker was one of the finest and most original clinical teachers of surgery of his generation. It was common remark that he was among the first to adopt the bedside clinic to the theory of practice. He held this chair for thirty years and it is probable no surgeon in New York ever surpassed him as a clinical teacher, or equalled him in the inspiration for critical surgical analysis which he was able to convey to his admiring students.

In addition to this galaxy of master surgeons whose constructive work as teachers and organizers of systematic surgical study in the cities of New York and Boston there were those of the University of Pennsylvania equally celebrated in the city of Philadelphia. Philip Physick (1768–1837) was one of them. His long and intimate association with John Hunter had given him a prestige amongst his colleagues which was immediate and enduring. He had lived in Hunter's house as a member of his family and became so great a favorite, that at the end of his residence with him, Hunter asked him to become his partner. But he went on to Edinburgh where in 1792 he received his medical degree when only twenty-four. Returning to Philadelphia he was appointed surgeon to the Pennsylvania Hospital and in 1800 was given a lectureship in surgery. In 1805 the professorship in surgery was created and Dr. Physick was made professor. He occupied the chair of surgery for thirteen years and gave rare distinction to the systematic teaching of general surgery as an organized science.

Dr. William Gibson (1788–1868), who succeeded Physick, ably maintained the high reputation which the arduous labors of his distinguished predecessor had given the department of surgery. Gibson was one of Princeton's fine scholars and after his graduation there he went to Edinburgh to be with John and Charles Bell. He took his medical degree from the University of Edinburgh; his graduating thesis was on the subject of "Necrosis" and was so fine it gave him instant distinction. On his return to America he was given the chair of surgery in the University of Maryland and in 1819 succeeded Physick as professor of surgery in the University of Pennsylvania.

In addition to these great surgeons whose training was directly derived from Home, Abernethy, Hunter and Cooper, were Bigelow of Boston, Gross and Agnew of Philadelphia, James R. Wood of New York, Donald Maclean of Detroit and Ann Arbor, who was for many years James Syme's first assistant, and Moses Gunn of Chicago. These men were directly or indirectly influenced by the early British masters, of whom John Hunter was their ideal, and by Joseph Lister with whom most of them were contemporary.

They were clever anatomists and some of them, inspired by the epochal work of Lister in pathology and bacteriology, became devoted disciples of this great teacher in the early adoption of the principles of antiseptic and aseptic surgery. For it must not be forgotten that Lister was the first to suggest and put in practice asepsis, as he had been the first to detail the principles of antisepsis.

The Senior Fellows of this association will recall with me the steam atomizer used in the operating ampitheatre in the early 80's and the phenolized fog which blinded us as we tried vainly to gaze through the choking fumes. Fortunately this method of rendering the atmosphere of the operating room sterile soon gave way to the aseptic technique in the preparation of instruments, dressings and everything which contacted the field of operation;

and by 1890 we had established an aseptic technique so meticulous in its detail that it never has been surpassed and now, after forty years, is scarcely equalled in the modern operating room. But it must not be forgotten, that, however great the obligation to Hunter Bell, Pott and Cooper, great anatomists and physiologists in their day (great constructive mentalities in establishing the art and science of surgery in the English speaking world) equally great is our debt to those who followed them and perfected the science which the early masters so vaguely outlined. For in Lister, Macewen and Horsley (and although still living, we should like to add Mayo-Robson) Britain gave to America and the whole world, not only the creative geniuses who made possible the perfected art we now enjoy, but with a dramatic and episodic flare, unexampled in the annals of science, gave to our guild the very highest development in the domain of specialized surgery. They were the first to approach the great problems of surgical pathology with the uncompromising analysis which made possible its interpretation in terms of a definite surgical remedy. They studied the function and minute anatomy of various organs both as discrete entities and in their correlated reactions with other organs contiguous to them. Their discoveries revealed the importance of bacterial infection both local and disseminated and they established the fundamental laws which govern surgical procedure in the complicated pathology of a disseminated infection. Through them and their incomparable labors the art of surgery has approached the state of a perfected science. By their modest, untiring but courageous, and at times revolutionary efforts they have left a legacy of scientific accomplishments whose luster will never fade.

So much has been said of late in the anniversary biographic reviews of the lives and works of John Hunter and of Lord Lister that it would seem improper to review their epochal work again. One writer has recently said: "The history of surgery can, in fact, be divided into two periods—before Lister and after Lister." But Lister had an admiring colleague, who, like Lister, was a great pathologist and a still more accomplished physiologist. No review of the work of the master minds in British surgery would fail to pause before this luminous figure, the most modest and withal the most outstanding in stellar brilliance in the history of surgery. Victor Horsley's fame, to those who knew indirectly of his life of vast research, eminated from his work in localization and surgery of the brain and cord. And while that was where his creative faculties had their finest expression, he was, in fact, equally great in his work in physiology, pathology and the general field of surgical research.

It is true he has been known in America chiefly for his epochal studies in localization of the centers of the brain and his rare genius in brain surgery. But he distinguished himself also in his original work on the thyroid gland and his notable studies in confirmation of the work of Pasteur in rabies.

In 1880 at the age of twenty-three he became fellow of the Royal College of Surgeons. In 1884 at the age of twenty-seven he was appointed Professor Superintendent of the Brown Institution and began his notable work with Professor Schafer and Dr. Beevor. He discovered the nerve distribution to the major nerves, the "nervi-nervorum," by a special method of staining. At the Brown Institution, where he was Professor Superintendent for six years, he followed three lines of research: (1) the localization of function in the brain and the pathology of epilepsy and canine chorea; (2) the thyroid gland with special reference to cretinism and myxedema; (3) the protective treatment against rabies.

On April 4, 1883, Dr. Theodor Kocher gave an address at the Twelfth Congress of the German Surgical Association on "The Extirpation of Goiter and Its Conse-

quences," which was published in *Langenbeck's Archives*. He called the condition found in these cases "Cachexia Strumipriva." During April and June, 1883, the Reverdins published in the *Revue de la Suisse Romande* their "Note sur vingt-deux operations de goitre." They were acquainted with the British reports on myxedema and considered the *rapprochement complet* between the English cases of myxedema and their own cases of *myxoedeme opératoire*.

On November 23, 1883 at a meeting of the Clinical Society of London, Sir Felix Semon, calling attention to Theodor Kocher's observations, declared his belief that "cretinism, myxedema and cachexia strumipriva were closely allied conditions in which there was either complete degeneration or absence of the thyroid gland." On December 14, the Clinical Society appointed a committee to investigate this subject of which Ord, Hadden and Horsley were members. Recognizing what they called "the hitherto undreamed-of importance of the thyroid gland" they selected Horsley to study the subject by experimental physiology. He began his work in Professor Schafer's laboratory in the autumn of 1884. The report of the Investigation Committee was not published, however, until 1888. It contained 215 pages and is everywhere accepted as the first authentic experimental study of the thyroid gland.

On February 8, 1890 Horsley published his "Note on a possible means of arresting the progress of myxedema, cachexia strumpriva and allied diseases." He considers the work of Professor Schiff, published in 1884 in the *Revue de la Suisse Romande* and of von Eisselsberg on the transplantation of normal thyroid tissue in the body of a patient suffering from myxedema, and recommends this procedure which had been attempted by Kocher in 1883 unsuccessfully and again by the same surgeon successfully in 1889.

In the *British Medical Journal* of October 29, 1882, Fox of Plymouth and Hector

Mackenzie published their papers on feeding fresh thyroid and the dry extract by mouth. During 1893 a large number of cases were reported, aiding the experimental work and clinical study of the thyroid. Horsley does not stand alone but, in the words of Paget, "It was he who founded in this country (England) the modern study of the thyroid gland; and it was he who first in this country suggested the rational method of treatment. Those of his profession who remember the years of ignorance and the wonder and delight of the new learning, are not likely to forget what he did in 1884–86 for science and in 1890 for practice."

The work of Horsley on the prevention of rabies in England was not less romantically epochal than his research work on the thyroid gland. Pasteur treated his first patient for rabies on July 6, 1885. In April, 1886 a commission composed of outstanding men in England was appointed by the British Government to visit Pasteur and learn of his method of treating rabies. The distinguished names on this commission is an index of the importance attached to this investigation by Great Britain. They were Sir James Paget, chairman, Lord Lister, Sir Lauder Brunton, Sir Richard Quain, Sir Henry Roscoe, Sir John Burdon Sanderson, Dr. George Fleming and Victor Horsley, Horsley was secretary of the Commission.

Sir James Paget wrote a letter to Pasteur telling of the appointment of the Commission and desiring to arrange an audience. This letter was borne in person by Sir John Burdon Sanderson. Brunton, Roscue and Horsley followed a few days later to Paris. They wanted to bear back with them an infected spinal cord and an inoculated rabbit to prove Pasteur's claims.

Pasteur proved difficult at first, but Horsley's grace and tact finally won the desired material. A number of cases were placed at the disposal of the Commission for study. Horsley returned early in May to London after seeing over 100 cases in Paris and in various parts of France to

which Pasteur referred him. Horsley's biographer found amongst his papers twenty-six letters written to him by Pasteur between May, 1886, and July, 1887.

The report of the Commission says that "Horsley's experiments begun in May, 1886 entirely confirm M. Pasteur's discovery of a method by which animals may be protected from the infection of rabies." It would be difficult to overestimate the importance of the discovery whether for its practical utility or for its application in general pathology.

The conduct of the experimental studies on rabies was greatly facilitated by the appointments at the Brown Institution where Horsley was superintendent and where he continued these experimental investigations. They were all brilliantly confirmatory of Pasteur's claims. During this year there was a startling outbreak of rabies amongst the herds of deer in Richmond Park. By April 1887, 160 deer out of the herds of 1200 had died of this disease. Before the disease had been checked 264 deer had died of rabies. Horsley conducted inoculation tests at the Brown Institution throughout the epidemic, abundantly confirming all cases studied.

A bill requiring dog owners to muzzle their dogs for a certain period of quarantine passed the House and became a law. But as was and has been true of every scientific advance in preventive medicine the enforcement met the same fanatical resistance which has characterized the anti-vaccinationists since Jenner's day. Horsley considered hydrophobia the most terrible in its terminal expression of any disease of which he had knowledge and felt it his professional obligation to give its study his most earnest and devoted labor. He was the greatest and most distinguished advocate and friend Pasteur ever had in the establishing and promulgation of his priceless discovery.

Because of his outstanding and original investigations in cerebral localization Victor Horsley became easily the first authority in the world in the diagnosis of intracranial pathology. It followed naturally from his long and strict training in experimental physiology, reports of which, in collaboration with Schafer, Beevor, Semon and Ferrier, were made before the Royal Society, that he should elect the surgery of the brain and cord as the field in which he could work with the greatest facility. So widely was this leadership accepted that a senior surgical service was created for him in the Queen's Square Hospital.

It was there on May 25, 1886 that he did his first definitely planned operation on the brain. It was the excision of a scar following a crushing accident with loss of brain substance occurring several years before. It was a classical case of Jacksonian epilepsy. Horsley removed the scar and some of the brain substance contiguous to it and the patient recovered with improved mental condition and freedom from his convulsions. Hughlings Jackson was present at this operation.

On June 9, 1887, he removed a tumor from the spinal cord, the first operation of its kind in the history of surgery. It was a patient of Gower's and was reported by Gower and Horsley in the *Transactions of the Royal Medical and Chirurgical Society*. On March 5, 1888 at a meeting of the Medical Society of London, Horsley and Ferrier reported a case of cerebral abscess operated on with complete recovery on December 10, 1887, and in this meeting referred in his discussion to a case of septic thrombosis operated on by ligating the internal jugular vein and removing the infected clot from the sinus. This operation was done early in 1886 and was the first of its kind. It was reported on May 28 before the London Clinical Society in a paper by Horsley, "On a case of suppuration of the mastoid cells with remarks on the prevention of septic embolism in such cases."

In January, 1887 Horsley did the first trephine operation ever reported for relief

of the intracranial pressure in a patient suffering from an inoperable brain tumor. This procedure was done for the relief of pain, vomiting and optic neuritis. Cushing later designated this palliative measure as "decompression." In June, 1890 he read a paper prepared from experimental data which he and Spencer gathered from their work in the Brown Institution "On the changes produced in the circulation and respiration by increase of the intracranial pressure or tension."

At the August meeting of the International Medical Congress in Berlin he reported his work on the physiology of the brain and its function in collaboration with Schafer, Beevor and Semon. His demonstrations were before a large and distinguished assemblage of physiologists and surgeons from all parts of the world, critical to a degree; but before he was through with his brilliant and startling demonstrations they acclaimed him with the highest honors.

It would be impossible to enumerate the vast collection of original scientific data which every year, with increasing abundance, distinguished the untiring labors of this greatest of England's master surgeons. The accuracy, originality and brilliantly suggestive character of his work was enthusiastically acknowledged throughout the scientific world. His laboratory and clinics were crowded with those seeking to learn these new and priceless facts in neurologic physiology and surgery. No one in his generation could approach him in productive effort nor keep up with the pace with which his great mind solved those delicate and abstruse problems of the human brain and cord. He wore out and left behind every assistant who ever attempted to keep up with him. This I know personally and from numbers of men who were under his training. The fame and crowding honors which came so early to this young genius continued to come for more than a quarter of a century. Throughout he was the same modest gentleman of true

science, glad at all times to accord to those so fortunate as to collaborate with him, the generous share of credit. In Schafer, Beevor, Semon, Gotch, Spencer and Ferrier he had loyal and staunch friends and co-workers. But ever he was the leader of them all, inspiring them to greater and more difficult achievements.

When he resigned as professor of pathology in the University College a Department of Experimental Neurology was created for him and he was given his old laboratory in which to continue his work. One of his colleagues writes: "There he was always to be found on certain afternoons of the week tackling fresh problems with undiminished ardour as the pages of *Brain* testify. None who has ever worked there under his aegis are likely to forget his infectious keenness and his unequaled generosity. All that he asked for was that men who came there should be workers; and they did come, from home, from the colonies, from America, Germany, Poland, France and elsewhere. It was a matter of indifference to him whether their researches were published with or without his expressed collaboration; all recognized that he was the leading spirit in the international coterie that labored in that odd-shaped and out of the way room, which to many of the younger generation of neurologists at home and abroad was a veritable Mecca."

At the Toronto meeting of the British Medical Association in July, 1906 he was selected to deliver the "Address on Surgery." A distinguished surgeon of New York, who was present, told me all the other sections were deserted to hear this great address. In the same week Horsley reported his studies with Robert H. Clarke on the differentiation of lesions of the cerebellar cortex from those of the cerebellar nuclei. Clarke had devised a most intricate stereotaxic instrument to facilitate this research. It was constructed so that an insulated platinum electrode could be passed below the cortex into any

of the planes within the nucleus. At first the cells in the nucleus were stimulated by gradually increasing degrees of intensity until absolute electrolytic destruction of every cubic millimeter of the nucleus had been thus stimulated and finally decomposed. The most elaborate tracings, records and photographs, microscopical and gross, were made and were exhibited with this report. It was the first employment of electrolysis in experimental physiology and in its original conception the greatest piece of work ever done in intracranial differentiation.

On their return to England in August I joined them for a fortnight in Norfolk at Westwick Hall. They were still animated by the thrill of their great discovery and I spent many nights far into the early morning hours reviewing with them this amazing work and examining their equally wonderful photography of it.

This quite compendious recital of but a few of the hundreds of original and epochal works and experimental demonstrations in the physiology and pathology of the brain and spinal cord made by this great master would be singularly inadequate were one to omit mention of one of the rarest examples of localizing precision and operative skill in the history of brain surgery. We are indebted to Stephen Paget for this graphic description, amongst a host of others. It was on the definitive impulses from the precentral gyrus. "What are the powers embodied in the precentral gyrus?" "What sensory impulses are accumulated in it rendering it serviceable to the movements of the upper limb?" He answers this question with a case from Queen's Square. The patient was a boy of fourteen with a case of violent convulsive movements of the upper limb; they had begun when he was seven; "He was in a distressing condition and was referred to me by Risien Russel with a view of arresting the spasm by an operation. Having stopped athenoid and clonic movements in two previous cases by the excision of the so-called motor area, I advised that the arm area in this case be delimited by excitation and then removed."

On March 20, 1908 Horsley exposed the right precentral and postcentral gyri, mapped out exactly, by electrical stimulation, the whole arm area (precentral gyrus) and removed it. The convulsive movements immediately stopped and more than a year later, at the time of the Linacre lecture, there was no sign of any return of them. He attributed this return of purposive movements chiefly to compensatory action of the postcentral gyrus. Tactile sensation, the "feel" of the muscles and joints (muscle sense, arthric sense), the appreciation of temperature and of pain, the ability to identify a point touched (topognosis) were impaired and there was profound impairment of the ability to recognize, by contact, the shape of solid objects (stereognosis). Thus, from this one case, Horsley was able to say that the gyrus precentralis is, in man, the seat of representation of (1) slight tactility; (2) topognosis; (3) muscular sense; (4) arthric sense; (5) stereognosis; (6) pain; (7) movement.

Many of his American students have testified to his personal charm both as friend and teacher. Ernest Sachs of St. Louis said: "I had the rare privilege of working with him from September, 1907 to December, 1908 . . . Of the many privileges that I have had in my life working with various great men, that year and a quarter I spent with him I prize as the most valuable and delightful I ever had."

Notwithstanding the many diverting influences which crowded into the life of this much sought after scientist his surgical activities continued unabated. Up to February, 1909 he had operated on 21 cases of that most rare disease, chronic spinal meningitis, without a single death. On November 22 he reported 149 operations on the Gasserian ganglion with 7 per cent mortality. Of the patients under fifty years of age none had died.

In the spring of 1902 he received the honor of knighthood. It came as a complete surprise to him and he never even knew who recommended him. It had been said by some that he had begun to lose interest in professional matters shortly before the war and devote more of his time to sociological and political affairs. But the honors and recognition of his great contributions to the science of surgery continued to pour in upon him from every quarter of the world. At thirty-three he was elected an honorary member of the American Surgical Association. At thirty-eight he was made a Corresponding Member of the Société de Chirurgie de Paris. The same year membership in the Athenaeum was given him without ballot and the Fothergillian Prize was awarded him by the University of London. Two years later he was elected to the Medical Council and a month later was appointed on the Senate of the University of London. The following year he was elected President of the Neurological Society of which he was one of the founders.

In 1900 and 1901 he was one of the active spirits in the reorganization of the British Medical Association and at the Swansea meeting he was Chairman of Representation. At the Toronto meeting of the British Medical Association, where he delivered the Address on Surgery, in which he gave a summary of twenty years of surgery of the brain and cord at Queen's Square, the University conferred upon him the degree of Doctor of Laws.

Early in 1910 he was elected a foreign associate of the French Academy of Medicine. In July of the same year he was elected corresponding member of the Royal Prussian Academy of Sciences. The same year he was made President of the Section of Surgery of the British Medical Association. In May, 1912 he was elected a member of the Royal Society of Science of Upsala in succession to Lord Lister. In December of the same year he was elected an honorary fellow of the Italian Society of Neurology. January 19, 1911, three years before the war, the Lannelonge Prize, just instituted by Professor Lannelonge of the University of Paris, was awarded to him, a gold medal and 5000 francs, "for the surgeon who in the previous ten years shall have done most for the advancement of surgery; to be awarded once in five years by a committee of surgeons, representatives of many nations, Great Britain and Ireland; the United States and Canada; South America, Japan and China; Italy, Spain, Portugal and Mexico; Scandinavia and Holland; Belgium, Germany and the Balkan States, one representative of each of these nations or group of nations." "Horsley received this unexampled honor," writes Paget, "the first Lannelonge Prize, from the hands of the President of the Société de Chirurgie. He spoke a few words of thanks and of compliment to Professor Lannelonge and said that his own country, which had long been under the influence of John Hunter's teaching, had later come under the influence of Claude Bernard, who had joined together physiology and surgery. 'That is what I have striven to realize. Unfortunately, if surgery advances with fair rapidity its practice progresses more slowly. That is because we are held in bondage by traditions from which we have difficulty in freeing ourselves.'"

Sir Victor was approaching the climax of a life of unexampled scientific effort. He had been acclaimed with a long procession of honors never before or since accorded to one of our guild. He had entered the medical service immediately upon the entrance of his country into war, had gone to France and shortly after been made executive Medical officer of the Gallipoli base with headquarters at Alexandria. After the fiasco at Gallipoli he volunteered for Mesopotamia, where the medical conditions were in appalling chaos. I had received a long autograph letter from him from Alexandria telling of the failure at Gallipoli and later another from Bombay describing the frightful conditions along the Tigris.

In grave apprehension of the hazard he was taking, his friends wrote and cabled, imploring him to leave the work in Amara in younger hands. These warnings came too late. They probably would not have been heeded in any event by this great spirit whose whole life had been a symphony of devotion to the welfare of his fellow men.

He was on duty at Amara up to the day before his death, when he had walked miles through the withering heat to attend a sick brother officer, and on Saturday evening, July 15, 1916 he was carried into the hospital. The next day his temperature rose to 107°, he became unconscious and on the evening of July 16, in a little hospital by the Tigris, on the burning plains of Mesopotamia, the name of the greatest surgeon in the history of England passed to the roster of the immortals.

These were some of the notable British masters who gave inspiration and impetus in the development of the art of surgery to the American student who visited them. Those of us whose study in the clinics of the Continent lent enrichment to our professional experiences may well remember the great obligation American surgery will always owe to our British teachers. No student of the genesis and development of an art can be oblivious to the achievements of the master minds whose constructive ideals created it. No student of the history of surgery can fail to accord to the great masters in surgical research in Britain the highest meed of tribute. They were the attendants on kings and princes, the companions of the most gifted minds in letters and in art and the noblest in the history of our guild.

BOOKS RECEIVED

All books received by The American Journal of Surgery are listed in this column as soon as possible after their receipt and this must be considered as adequate acknowledgement. Books that the Editor considers of special interest to our readers will be reviewed in a later issue.

ANGINA PECTORIS. By Harlow Brooks, M.D. N. Y., Harpers & Brothers, 1929.

ARTHRITIS AND RHEUMATOID CONDITIONS. Their Nature and Treatment. By Ralph Pemberton, M.D. N. Y., Lea & Febiger, 1929.

BLOOD AND URINE CHEMISTRY. By R. B. H. Gradwohl, M.D. and Ida E. Gradwohl. St. Louis, C. V. Mosby Co., 1928.

DISEASES OF THE THYROID GLAND. Ed. 2. By Arthur E. Hertzler, M.D. With a Chapter on Hospital Management of Goiter Patients. By Victor E. Chesky, M.D. St. Louis, C. V. Mosby Co., 1929.

ENDOCRINE DIAGNOSTIC CHARTS. By Henry R. Harrower, M.D. Glendale, Calif., Harrower Lab., Inc., 1929.

THE HISTORY OF HEMOSTASIS. By Samuel Clark Harvey, M.D. N. Y., Paul B. Hoeber, Inc., 1929.

THE INJECTION TREATMENT OF HEMORRHOIDS. By Charles Conrad Miller, M.D. Chicago, Modern Surgery Pub. Co., 1929.

INJECTION TREATMENT OF INTERNAL HEMORRHOIDS. By Marion C. Pruitt, M.D., L.R.C.P., F.R.C.S., F.A.C.S. St. Louis, C. V. Mosby Co., 1929.

INTRODUCTION TO THE HISTORY OF MEDICINE. Ed. 4. By Fielding H. Garrison, M.D. Phila., W. B. Saunders Co., 1929.

KYKLOS. Jahrbuch des Instituts für Geschichte der Medizin und der Universität. Vol. 1. Leipzig, Georg Thieme, 1928.

PHYSICAL THERAPEUTIC TECHNIC. By Frank Butler Granger, M.D. Phila., W. B. Saunders Co., 1929.

PROCTOLOGY. A Treatise on the Malformations, Injuries and Diseases of the Rectum, Anus, and Pelvic Colon. By Frank C. Yeomans, M.D., F.A.C.S. N. Y., D. Appleton & Co., 1929.

REPORT ON FOURTH INTERNATIONAL CONGRESS OF MILITARY MEDICINE & PHARMACY, Warsaw, Poland, May–June, 1927. By Com. William Seaman Bainbridge, M.C.–F. Menasha, Wis., George Banta Pub. Co.

THE SCIENCE AND PRACTICE OF SURGERY. Ed. 2, 2 vol. By W. H. C. Romanis, M.B., M.CH., F.R.C.S., F.R.S. and Philip H. Mitchiner, M.D., F.R.C.S. N. Y., William Wood & Co., 1929.

A SHORTER SURGERY. A Practical Manual for Senior Students. By R. J. McNeill Love, M.B., F.R.C.S. N. Y., William Wood & Co., 1929.

A SURGICAL DIAGNOSIS. By J. Lewi Donhauser, M.D., F.A.C.S. N. Y., D. Appleton & Co., 1929.

SURGICAL RADIOLOGY. By A. P. Bertwistle, M.B., CH.B., F.R.C.S. Phila., P. Blakiston's Son & Co., 1929.

THE TECHNIC OF LOCAL ANESTHESIA. Ed. 4. By Arthur E. Hertzler, M.D., F.A.C.S. St. Louis, C. V. Mosby Co., 1928.

LE TRACTUS THYRÉOGLOSSE. Embryologic Topographique. Pathologic Chirurgicale. By G. Rémy Néris. Paris. Gaston Doin & Cie, 1929.

ULCÈRES DE L'ESTOMAC ET DU DUODÉNUM. By Victor Pauchet, Gabriel Luquet and A. Hirchberg. Paris, Gaston Doin & Cie, 1929.

WHY WE ARE MEN AND WOMEN OR FACTORS DETERMINING SEX. By A. L. Benedict, M.D. F.A.C.P. N. Y., Allen Ross & Co., 1929.

THE WRITING OF MEDICAL PAPERS. Ed 3. By Maud H. Mellish-Wilson. Phila., W. B. Saunders Co., 1929.

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